
Murderers Creek Wild Horse Joint Management Area

Proposed Appropriate Management Level Determination

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Summary

The proposed appropriate management level for the Murderers Creek Wild Horse Joint Management Area is 50 to 140 wild horses. This is consistent with the appropriate management level in the John Day Basin Record of Decision and Resource Management Plan and is similar to that established by the Malheur National Forest Land and Resource Management Plan, as amended. The appropriate management level from this analysis will be part of the proposed action analyzed for the Murderers Creek Wild Horse Joint Management Area plan.

The joint management area has sufficient water, forage, cover, and space to support wild horse populations and healthy rangelands over the long term. The upper limit of 140 wild horses is the result of applying management constraints including Forest Plan and Resource Management Plan direction, Bureau of Land Management standards for rangeland health, and protection for the threatened Middle Columbia River steelhead. The lower limit is a number that would allow the herd to grow over four to five years without needing to remove excess wild horses.

An upper level of 140 horses is probably not large enough to avoid inbreeding depression (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013). Therefore, management actions may be needed to maintain the genetic variability of the herd over the long term. Possible actions include the following:

- Maximize the number of breeding age horses in the herd (animals age 6 to 10 years). This could increase the need for removal to keep the herd size at 50 to 140 horses.
- Introduce one or two young mares from outside the joint management area every generation (about every 10 years). Introduced animals should come from herds living in similar conditions.

Introduction

This document details the process used to identify appropriate management level for the wild horse herd in the Murderers Creek Joint Management Area. It also defines the appropriate management level as a clearly defined range. The 1990 Malheur National Forest Land and Resource Management Plan (Forest Plan) (USDA Forest Service 1990) established a management level of an average of 100 wild horses in the Murderers Creek Joint Management Area. The John Day Basin Resource Management Plan and Record of Decision (USDI BLM 2015) established a range of 50 to 140 horses as the appropriate management level.

The Murderers Creek Wild Horse Territory/Herd Management Area in eastern Oregon was established in 1972. It encompasses approximately 143,000 acres of Federal, State and private lands (see Figure 1). The Forest Service and Bureau of Land Management use different terminology when referring to the areas managed for wild horses. The Forest Service uses Wild Horse Territory; the BLM uses Herd Management Area. In this document, we use Joint Management Area to incorporate the terminology of both agencies.

The goal of establishing an appropriate management level is to manage wild horses to achieve and maintain a thriving natural ecological balance and multiple-use relationship on public lands. This is required by the Wild Free-Roaming Horses and Burros Act of 1971, as amended (Public Law 92-195; December 15, 1971). To achieve this goal, wild horses on the Murderers Creek Joint Management Area should be managed to ensure significant progress toward achieving goals and objectives in the Malheur Forest Plan and the John Day Basin Resource Management Plan. This means meeting

standards and guidelines for upland vegetation and riparian plant communities, watershed function, and habitat quality for fish and wildlife populations and meeting the direction in the *Standards for Rangeland Health and Guideline for Livestock Grazing Management for Public Lands Administered by the BLM in the States of Oregon and Washington* (USDI BLM 1997). It also means meeting objectives to protect and manage threatened, endangered, and sensitive species. Specific management direction is discussed in detail in the *Land Use Plan Direction* section of appendix A.

Location and Habitat

The Murderers Creek Wild Horse Joint Management Area is located in eastern Oregon between the towns of Dayville, Mount Vernon, and Seneca. The area lies north of the Izee highway (County Road 63), south of Aldrich Mountain, east of the South Fork John Day River and west of Flagtail Mountain. It is within the Upper John Day River subbasin. Major drainages include Murderers Creek, South Fork Murderers Creek, Deer Creek, and Indian Creek. The South Fork John Day River and several of its tributaries support federally listed Middle Columbia River steelhead (*Oncorhynchus mykiss*); there are 92.23 miles of designated critical habitat for the fish in the joint management area.

Elevation ranges from 3,250 feet to almost 7,000 feet. The climate is described as hot and dry in the summer (temperatures exceeding 90 degrees Fahrenheit) to cold winters with temperatures of below zero degrees Fahrenheit. Average annual precipitation ranges from 11.5 inches in the lower elevations to about 30 inches at the highest elevations. Most precipitation occurs as snowfall between November and April.

The joint management area is dominated by coniferous trees. Vegetation types range from Douglas-fir/elk sedge and grand fir/elk sedge with dense canopy cover to more open areas of ponderosa pine/mountain mahogany/Idaho fescue-bluebunch wheatgrass. There are steep, timbered slopes bisected by relatively narrow stream channels. North-facing slopes have more trees; south-facing slopes are more open, often with rock outcrops or serpentine soils. There are areas of rolling to flat lands bisected by very steep rocky canyons. Herbage production ranges from 50 pounds per acre to 800 pounds per acre depending on the vegetation type.

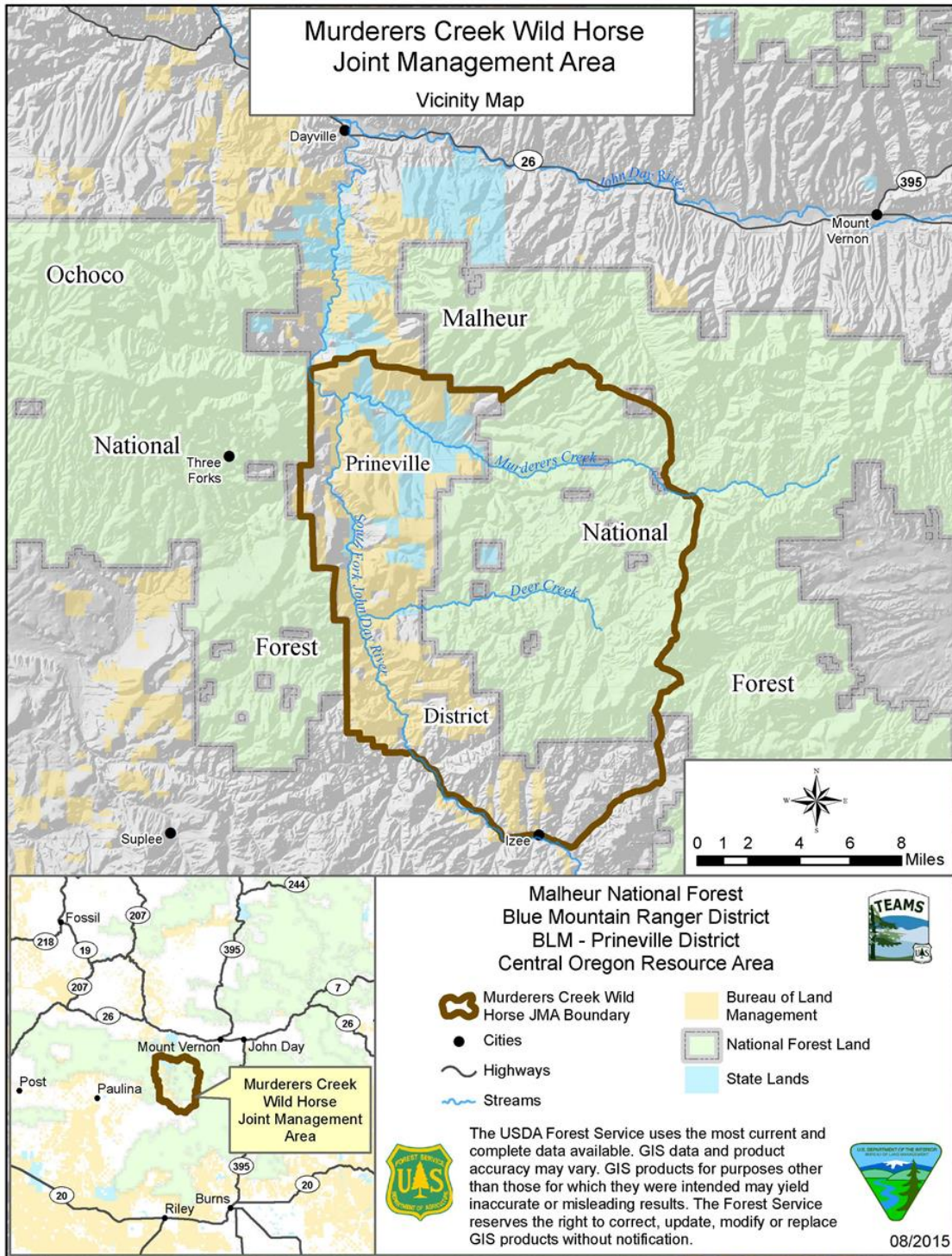


Figure 1. Murderers Creek wild horse joint management area

Analysis Process

The Forest Service manual (FSM 2260) directs us to establish population levels by considering (a) number of animals, (b) suitability of range, (c) range condition and trend, and (d) other associated resources and resource use activities (USDA Forest Service 2003). The process detailed in the BLM Wild Horses and Burros Management Handbook H-4700-1, appendix 3 (USDI BLM 2010) meets the direction outlined in the Forest Service manual.

The National Academy of Sciences National Research Council committee was recently tasked with investigating how we could use the best science available to improve management of horses and burros on the range (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013). One of their determinations was that while the Bureau of Land Management Wild Horses and Burros Management Handbook H-4700-1 (USDI BLM 2010) provides some degree of consistency in goals, allocation of forage, and general habitat considerations, it lacks the specificity needed to adequately establish and adjust AMLs. They also found that how appropriate management levels are established, monitored, and adjusted is not (1) transparent to stakeholders, (2) supported by scientific information, and (3) amenable to adaptation with new information and environmental and social change. Fully aware of its limitations, we will use the Bureau of Land Management handbook (USDI BLM 2010) for this analysis, and incorporate as much information from the committee report as feasible.

The details of the multi-tiered analysis process described in the Bureau of Land Management Wild Horses and Burros Management Handbook H-4700-1, appendix 3 (USDI BLM 2010) are included in appendix C of this document. The process includes these three tiers:

- Tier 1: Determine whether the four essential habitat components (water, forage, cover, and space) are present in sufficient amounts to sustain healthy wild horse populations and healthy rangelands over the long term.
- Tier 2: Determine the amount of sustainable forage available for wild horse use by establishing the appropriate management level at a number below that which has contributed to standards and objectives not being met.
- Tier 3: Determine whether the wild horse herd size is sufficient to maintain a genetically diverse population and avoid inbreeding depression.

We deviated slightly from the Bureau of Land Management handbook when calculating the amount of forage available. When the National Academy of Sciences committee reviewed the handbook, they noted difficulties in using animal unit equivalents to evaluating forage availability (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013). In this analysis, the amount of forage is expressed in pounds rather than animal unit months to address the difficulties identified by the committee.

Tier 1 Analysis – Determining Sufficiency of Forage, Water, Cover, and Space

The purpose of the tier 1 analysis is to determine whether the four essential habitat components (forage, water, cover, and space) are present in sufficient amounts to sustain a healthy wild horse population as well as healthy rangelands over the long term.

The results of the tier 1 analysis are summarized in Table 1. The discussion of the analysis follows the table.

Table 1. Tier 1 summary: Forage, water, cover, and space sufficiency

	Water		Forage		Cover and Space	
	Sufficient	Insufficient	Sufficient	Insufficient	Sufficient	Insufficient
Wild Horse Territory						
Murderers Creek Wild Horse Joint Management Area	X		X		X	

Determining Water Sufficiency

Water is not a limiting factor in the joint management area. There are sufficient water sources, and they are well distributed as shown in figure 4. During extreme drought years, dependable water sources may go dry. However, there are enough other water sources less likely to go dry (for example, larger stream systems and several springs), and horses could still find water if necessary. During the winter months, snowpack can be up to 25 inches, and water sources may freeze in higher elevation sites. In the lower elevation areas, as characterized by the Dayville site data (table 2), snowfall is not sufficient to form a snowpack. We assume these low-elevation areas would provide water in the winter. Data in table 2 is from the three weather stations shown in figure 3.

Table 2. Mean snow depth (in inches) for the Starr Ridge, Snow Mountain, and Dayville sites

Month	Starr Ridge (SNOTEL Site 789)	Snow Mountain (SNOTEL Site 767)	Dayville, OR (WRCC 352173)
December	4.4	6.8	0.0
January	14.6	17.3	0.0
February	20.5	25.6	0.0
March	19.4	28.8	0.0
April	10.7	31.7	0.0
May	4.4	13.1	0.0

Source: <http://www.wcc.nrcs.usda.gov/webmap/index.html> and <http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?az3961>

Streams in the joint management area provide dependable water for livestock, wildlife, and wild horses throughout the year. The joint management area has approximately 214 miles of perennial streams, 281 miles of intermittent, and 205 miles of ephemeral streams (figure 4). Major streams include the South Fork John Day River, Murderer's Creek, Deer Creek, and Indian Creek. The Oregon Water Resources Department monitors streamflow in the South Fork John Day River, Deer Creek, and the Murderers Creek. Figure 2 shows the mean monthly flow for Murderers Creek which represents the streamflow pattern of all streams in the area. Spring runoff generally begins in March. High streamflows occur in late April when snowmelt is at its peak. The lowest flows occur in September.

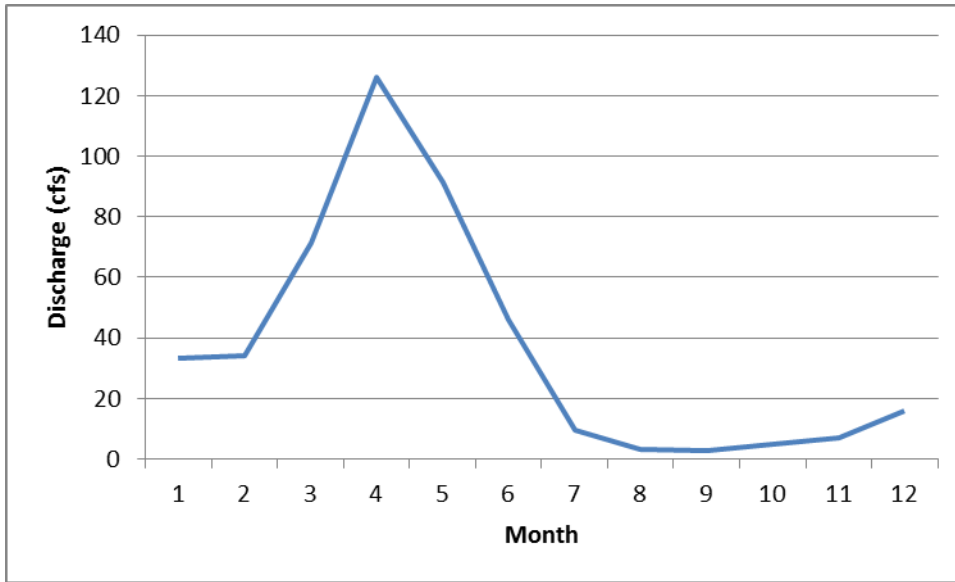


Figure 2. Mean monthly streamflow in Murderers Creek

In recent years, miles of stream have been fenced to help protect Middle Columbia River steelhead habitat (see Figure 6). Most of the fenced areas have water gaps – fenced areas that allow livestock restricted access to the stream. Gates in fences are opened when the livestock leave the pasture, giving the wild horses access to water.

While the fencing reduces water availability along the stream, there are upland water sources available. Forest Service personnel visited 31 water sources in 2014 and 2015 to conduct spring surveys for the Hydrology Report (see appendix B). An additional 147 water sources have been documented as range improvements and 237 from water rights data. These water sources are primarily springs but also include water developments such as stock tanks, troughs, ponds, and dams (figure 4). Most water sources are less than 1 mile apart (Malheur National Forest and Bureau of Land Management GIS data).

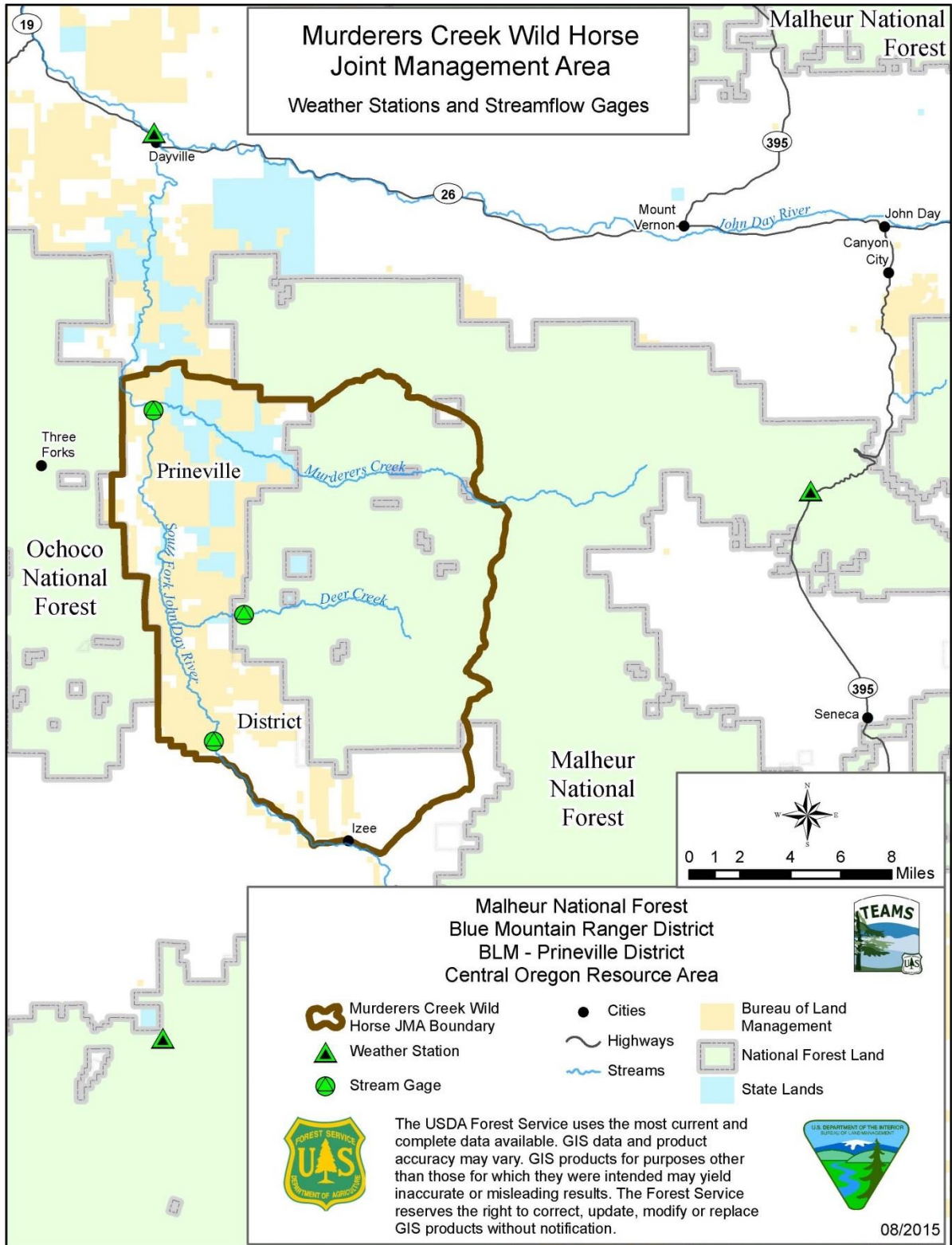


Figure 3. Stream gage sites and weather stations in and near the Murderers Creek wild horse joint management area

Climate change could affect the water availability in the joint management area; extended drought would likely reduce the reliability of spring sources. The warming of the region may result in more precipitation falling as rain rather than snow. This could change the timing and intensity of peak streamflow.

Determining Forage Sufficiency

To determine if forage is sufficient, we first took a hard look at the capability of the land within the joint management area to produce forage. Our calculations showed that the joint management area is capable of producing an estimated 23,269,530 pounds of forage in an average year.

We then disclosed the current grazing obligations of the area, discussing forage needs of cattle, wildlife and wild horses. We're using 'obligations' to refer the forage allocations identified in John Day Basin Resource Management Plan (USDI BLM 2015), the permitted livestock use (as identified on term grazing permits), the elk and deer management objectives from the Oregon Department of Fish and Wildlife, as well as the wild horse use. Our calculations showed an estimated 13,296,976 pounds of forage are needed yearly to meet the current grazing obligations within the joint management area. When these numbers are coupled with the utilization and land health data available we can see that the amount of grazing permitted or leased by the agencies, as well as that needed for wildlife and wild horses is within the amount of forage the area produces, resulting in our determination that forage is sufficient to sustain healthy wild horse populations and healthy rangelands over the long term.

The following sections summarize how we determined forage sufficiency. We analyzed utilization data, use pattern mapping and/or production, ecological site condition, trend, and other indicators of land health as described in the Bureau of Land Management Handbook H-4700-1 (USDI BLM 2010).

Calculating Forage Production

For this document we use pounds of forage rather than the routinely used animal unit months to express the amount of forage a grazing animal needs or utilizes. An animal unit month is defined as the amount of forage required by an animal unit for 1 month, and an animal unit is defined as one mature cow or the equivalent based upon average daily forage consumption of 26 pounds of dry matter per day (Kothmann 1974). The National Academy of Sciences committee noted there are difficulties in using animal unit equivalents when evaluating forage availability and notes that animal unit equivalents for horses range from 1.0 to 1.5 (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013). Using pounds of forage rather than animal unit equivalents allows us to display available forage and forage needed in a cleaner, more straight-forward method.

In 1983 an extensive production and utilization study of the Forest Service portion of the joint management area analyzed the forage available and the use by livestock, wild horses, and wildlife. The study determined no significant problems with proper use of the forage species given 100 head of horses, the natural elevation, seasonal migration, and scattered territoriality of the bands. Forage use by all species was well within the allowable use levels and the needs of all resources involved were being met (USDA Forest Service 1983).

To augment that 1983 study, we began this analysis by estimating the amount of forage produced in the joint management area. Using the available data and the protocol outlined below, we calculated the Forest Service and Bureau of Land Management lands are capable of producing approximately 23,269,530 pounds of forage in an average year. This number indicates the area's capability to produce forage. The use of this forage is discussed in the following *Forage Use* section.

For Forest Service lands, we used the spatial plant community type data and corresponding herbage estimates (Johnson and Clausnitzer 1992, Crowe and Clausnitzer 1997, Hall 1998). These herbage estimates were then refined for the local area (Wijayratne 2016). For Bureau of Land Management lands, we used the spatial ecological site typing data and data from corresponding ecological site descriptions. We combined that data with the soil vegetation inventory method data to refine the estimated production and provide site specificity. When forage production was listed as a range of numbers, we used the lowest number because the handbook directs us to use the most limited production years to avoid overestimating the forage.

The Bureau of Land Management Handbook 4700-1 directs us to consider only the primary range when determining the amount of available forage. Primary range is defined as the areas animals prefer to use when management is limited (USDI BLM 2010). The Forest Service Region 6 protocol for determining rangeland capability directs us to consider slope and distance to water (USDA Forest Service 2006). To meet the direction of both agencies, we removed areas incapable of producing forage based on soil types, roads, slopes greater than 60 percent, etc. We then reduced the amount of forage based on slope and distance from water using Holechek's sliding scale (Holechek 1988). Holechek's sliding scale reduces the amount of forage produced on slopes between 11 percent and 60 percent and considers slopes greater than 60 percent as ungrazable. We must consider slope because including steeper areas would likely overestimate forage production. While horses may use steeper areas, all classes of animals prefer flatter areas. A study of slope use by cattle, feral horses, deer, and bighorn sheep found all classes preferred slopes less than 19 percent (Ganskoop and Vavra 1987). Holechek (1988) also recommends considering forage more than two miles from a water source as ungrazable. In the Murderers Creek joint management area, this number is insignificant because only 0.2 percent of the area is further than one mile from a water source.

Spreadsheets detailing the calculations are available in the project record. Table 3 displays the production on capable lands (after removing areas incapable of producing forage as discussed above) by agency, and the reductions based on Holechek's sliding scale.

Table 3. Forage production of the joint management area, by agency

Slope	Forage Production Estimate, pounds	Reduction Based on Slope (from Holechek 1988)	Total Forage Production Estimate, pounds
Bureau of Land Management			
0-10 percent slope	2,569,000	0	2,569,000
11-30 percent slope	5,323,400	30 percent	3,726,380
31-60 percent slope	3,945,600	60 percent	1,578,240
Totals	11,838,000		7,873,620
Forest Service			
0-10 percent slope	3,788,609	0	3,788,609
11-30 percent slope	12,973,691	30 percent	9,081,583
31-60 percent slope	6,314,293	60 percent	2,525,717
Totals	23,076,593		15,395,909
Total for both agencies	34,914,593		23,269,529.9

The Bureau of Land Management Handbook H-4700-1 (USDI BLM 2010) recommends using the weighted average utilization method to calculate a carrying capacity estimate. This protocol was not used here due to a lack of data. Ideally this analysis requires a minimum of three to five years of monitoring data and only considers the acres receiving moderate, heavy, or severe utilization for each evaluation year. None of the allotments had annual utilization mapping data for every pasture, and for every year, two of the allotments had utilization mapping data for only one year, and acres with heavy use are limited – most use is less than 41 percent.

Forage Use

To determine the forage sufficiency we must next look at the current obligations of the forage resource, and the utilization monitoring data. We're using 'obligations' here to refer the forage allocations identified in John Day Basin Resource Management Plan (USDI BLM 2015), the permitted livestock use (as identified on term grazing permits), the elk and deer management objectives from the Oregon Department of Fish and Wildlife, as well as wild horse use currently identified in the land resource management plans.

Table 4 displays a summary of current forage needs, the details describing the calculation of these numbers follow in the next three sections (*Permitted Livestock Use*, *Elk and Deer Use* and *Horse Use*). It is crucial to note that the numbers displayed in Table 4 are meant to disclose the forage needs of grazing animals within the joint management area, at the levels currently identified in the land resource management plans, grazing permits/leases and the wildlife management objectives of the state, for this analysis only. They are disclosed here only as a way to show the forage sufficiency of the joint management area.

Table 4. Summary of pounds of forage currently 'obligated' in the joint management area

Total pounds of forage needed for all livestock permitted/leased grazing (Table 10)	7,770,000
Total pounds of forage needed to meet management objectives for elk and deer in Murderers Creek and Ochoco wildlife management units (Table 13)	5,526,976
Total pounds of forage needed for wild horses, as identified in the current land resource management plans	1,330,000
Total	13,296,976

As discussed in the following sections, the livestock grazing authorized for the past several years was less than that identified on the term grazing permits, the number of mule deer and elk differ from the State's management objectives, and the number of wild horses differs from that identified in the land resource plans. To display those differences, we also calculated estimates of actual use for each, as displayed in Table 5.

Table 5. Summary of pounds of forage utilized yearly, based on actual use estimates

Total pounds of forage needed for authorized livestock grazing, average actual use (Table 11)	4,195,000
Total pounds of forage needed for elk and deer in Murderers Creek and Ochoco wildlife management units (Table 14), based on population estimates	4,680,109
Total pounds of forage needed for wild horses, based on herd size estimates	2,346,500
Total	11,221,609

Permitted Livestock Use

The joint management area overlays nine livestock grazing allotments administered by the Bureau of Land Management and five grazing allotments administered by the Forest Service (Figure 5). All allotments have permitted or leased (Bureau of Land Management) livestock grazing on them.

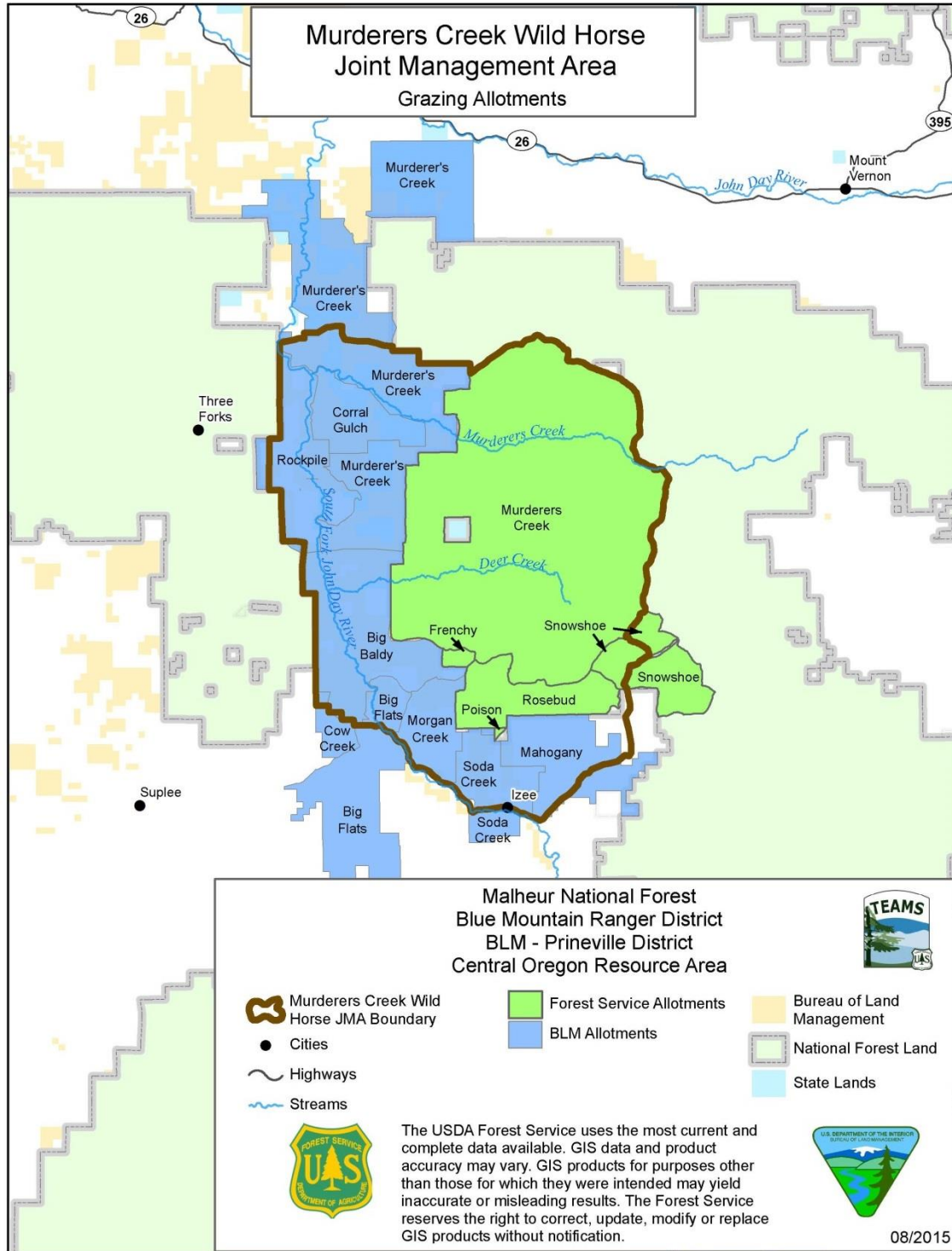


Figure 5. Forest Service and Bureau of Land Management grazing allotments

Total permitted or leased head months (number of animals multiplied by months) in the joint management area are 7,770. The amount of forage needed to support those head months is 7,770,000 pounds, based on 1,000 pounds of forage consumed by one cow-calf pair per month. However, authorized grazing and actual use has been lower than permitted and leased numbers on several allotments over the past several years. Because authorized and actual head months have been less than permitted and leased head months, the estimated forage used by livestock for the past several years is 4,195,000 pounds/year rather than 7,700,000 pounds/year. See appendix A for supporting information used to calculate these numbers.

Elk and Deer Use

The Oregon Department of Fish and Wildlife manages the Rocky Mountain elk and mule deer populations in the joint management area. The Murderers Creek wildlife management unit covers most of the joint management area, with the joint management area making up 18 percent of the total wildlife management area. Only 1.1 percent of the Ochoco wildlife management area is within the joint management area, along the west edge of the joint management area.

The amount of forage needed to support mule deer and Rocky Mountain elk populations at the stated management objectives for the two wildlife management areas is estimated as 5,526,976 pounds/year. Because the estimated populations have differed from the management objectives over the past several years, we also calculated forage use based on the population estimates. The estimated pounds of forage used by wildlife for the past several years is 4,680,109 pounds/year, rather than the 5,526,976 pounds/year that would be needed at the management objective levels. See appendix A for supporting information used to calculate these numbers.

From 2004 to 2015, the Oregon Department of Fish and Wildlife managed the elk in the Murderers Creek wildlife management unit at or above the management objective. In 2005 and 2006, the estimated elk population was 106 percent of the objective. In 2007, it was 134 percent, and from 2008 through 2015, it was 112 percent. The mule deer population management objective was not met from 2004 to 2015 in the Murderers Creek wildlife management unit. The highest population estimate was 77 percent of the objective in 2005 and 2009. Please see Table 12 in appendix A for details.

In the Ochoco wildlife management unit, the estimated elk population has not met the management objective since 2007. Since that time it has ranged from 87 to 96 percent of the objective. The management objective for mule deer was not met from 2004 to 2015. It dropped from 83 percent of the objective in 2004 to 72 percent in 2014. Please see Table 12 in appendix A for details.

Horse Use

The 1990 Malheur National Forest Land and Resource Management Plan (USDA Forest Service 1990) established a management level of an average of 100 wild horses for the joint management area. The newly implemented John Day Basin Resource Management Plan/ROD (USDI BLM 2015) established a range of 50-140 horses as the appropriate management level. Because we are looking at the obligations of the forage resource in this section we will assume the highest level allocated by the current land resource management plans, 140 horses.

A horse will consume 2.5 to 3 percent of their body weight daily (Holechek et al. 1995; Ensminger 1990) and we know that a mix of male and female adult horses in the analysis area weigh 800 to 1,000 pounds (based on observation of horses gathered from the joint management area in the past), so we will use an average consumption of 26 pounds of forage per day. With a daily consumption of 26 pounds, one horse will need approximately 9,500 pounds of forage per year. The direction in the current land resource management plans results in an obligation of 1,330,000 pounds of forage for

wild horses ($140 \times 9,500 = 1,330,000$). As discussed in the next subsection, we know there have been more than 140 horses in the joint management area for the past several years. So, we also calculated an estimated actual use of forage, based on herd size estimates, just as we did for livestock and wildlife. The average herd size from 2000 through 2016 is 247; $247 \times 9,500 = 2,346,500$ pounds of forage/year needed for wild horses at the average herd size.

Herd size estimates

Reports of the estimated horse herd size and the number of horses removed indicate it has been difficult to get an accurate count of horses in the joint management area since its establishment. We believe this difficulty in obtaining an accurate count has resulted in a continual underestimation of the number of horses present prior 2014. However, we must use these estimates in this analysis, as they are the best data available.

The earlier plans for the joint management area all identified that it has been difficult to obtain an accurate count (USDA Forest Service 1974, USDA Forest Service USDI BLM 1975, USDA Forest Service 1976, USDA Forest Service 1984). In 2000, the district began reporting herd size estimates and number of horses removed via the Forest Service agency-wide infrastructure database (INFRA), these numbers are displayed in table 6 to help illustrate that this is an ongoing issue. For example, in 2011 the estimated herd size was 238, yet in 2012 123 animals were removed and the estimated herd size was 257 which is more than is attributable to annual recruitment.

Since 2012, Forest Service and Bureau of Land Management personnel have been using new herd size estimates with an emphasis on reducing the percentage of error. In 2014 and 2016 census counts were conducted using simultaneous double-count aerial surveys. Data were analyzed to estimate sighting probabilities, and the raw counts were corrected for the undercounting known to occur in aerial surveys. Because the data were collected using the same protocol and subjected to the same statistical analyses, the herd size estimates can be refined using the pooled data from multiple years to estimate sighting probabilities. Future counts conducted with the same protocols and subjected to the same statistical analysis will help reduce the uncertainty associated with the wild horse herd size in the joint management area.

Table 6. Murderers Creek joint management area wild horse herd size estimates and removals from 2000 to 2016

Fiscal Year	Total Number Removed	Estimated Herd Size	Method Used to Estimate Herd Size
2000	0*	180*	Estimates*
2001	53*	165*	Estimates*
2002	0*	193*	Unknown
2003	6*	220*	Unknown
2004	55*	193*	Unknown
2005	99*	90*	Estimates*
2006	0*	430*	On-the-ground census from July to September 2006*
2008	136*	460*	Unknown
2009	77*	230*	Double actual count number, based on viewing conditions*
2010	46*	231*	Estimate based upon 2009 census and 2009 and 2010 removals.*

Fiscal Year	Total Number Removed	Estimated Herd Size	Method Used to Estimate Herd Size
2011	60*	238*	2011 census counted 132 animals with an estimate of 198 total; added the 20 percent recruitment to reach the estimated herd size of 238.*
2012	123*	257*	2012 census counted 161 animals. Applying a correction factor of 7.5 to 32 percent undercounted as described in Lubow and Ransom (2009) puts herd size estimate at 173 to 213. As of 6/27/2012 Without further gathers expect herd size to increase to 257 after the foaling season*
2013	175	No data	Numbers from Gather, Removal, and Treatment Summary Report (Sharp 2014)
2014	24 gathered from private land only (USDI BLM 2014)	254	Simultaneous double-observer protocol; Estimated herd size for 2014 was corrected by Lubow in 2016 using the additional data related to observer detection probabilities provided by the 2016 surveys.
2016	0	313	Simultaneous double-observer protocol (Lubow 2016). Using pooled data from 2014 and 2016 refined the estimates.

*As reported in the INFRA database (USDA Forest Service 2015)

Utilization Monitoring

The Forest Service and Bureau of Land Management routinely collect utilization data on grazing allotments in the joint management area. We disclose the utilization data here that are applicable to determining forage sufficiency, and that which will help frame the tier 2 analysis. More complete information about utilization monitoring in the joint management area is in appendix A.

Utilization of the uplands vegetation has been relatively light on the Bureau of Land Management allotments and moderate to light on the Forest Service allotments over the past several years, with the following exceptions:

- 2008 – Eighty-six percent utilization in the Frenchy Butte pasture with no authorized livestock grazing. This was attributed to extremely heavy use by horses in a large area at the head of Antelope Creek.
- 2013 – Seventy-seven percent utilization on the terraces in the Frenchy Butte pasture.
- 2013 – Eight areas of heavy use were identified around springs in the North and South pastures of the Big Baldy allotment and in the Morgan Creek allotment.
- 2015 – Heavy horse utilization in the Antelope Spring pasture precluded any livestock grazing in that pasture.

Standards to protect riparian and aquatic conditions have been exceeded at times by combined wild horse and wildlife use. In 2008, 2009, and 2011, streambank alteration end points¹ were exceeded in some locations where no livestock grazing was authorized. In 2007, 2010, and 2015, wild horse and wildlife use were heavy enough to preclude authorized livestock grazing in some areas.

¹ Selected end points, if not exceeded, allow attainment of, or reasonable progress toward meeting, desired conditions for riparian areas and fish habitat as described in the Forest Plan.

In 2008, the Forest Service increased pre-season and in-season monitoring to ensure end points are met. The following pre-season monitoring results are attributable to wild horse use:

- 2007 – Pre-season monitoring results revealed forage utilization levels higher than Forest Plan standards allow in some areas (for example, Vestor Meadows) where wild horses spend the winter and spring.
- 2008 – No livestock grazing was authorized on the Forest Service Murderers Creek allotment. Monitoring at 7 designated monitoring areas showed 2 sites exceeded streambank alteration standards. Three other sites showed enough bank alteration that the addition of cattle would probably have caused bank alteration standards to be exceeded.
- 2009 – The Blue Ridge/Lucera pasture (Forest Service Murderers Creek allotment) was not grazed by cattle because bank alteration was at 20 percent before cattle were scheduled to be in the pasture. Cattle were moved off the Murderers Creek allotment after 4 days in the John Young Meadows pasture.
- 2010 – Wild horse use sites in the Blue Creek drainage and Bark Cabin Creek required the permittee to keep cattle out of these areas.

We must note that in 2014 and 2015, bank alteration end points in Deer Creek designated monitoring area #2 were not exceeded when livestock returned to the allotment. During that time, the estimated number of wild horses was the same as, or larger than, years when the end points were exceeded. Agency personnel note that wild horses tend to avoid areas of human activity (for example, livestock handling, hunting, timber management, concentrated recreation). In this particular area, the grazing permittee is required to closely monitor riparian conditions to ensure end points are not exceeded. This increased level of human activity may have been enough to move the wild horses out of the area, in this instance.

Thus far in the *Forage* section of the tier 1 analysis we have calculated forage production, disclosed current obligations of the forage resource and discussed the utilization monitoring data. In the following sections we continue the analysis of the forage component by looking at indicators of land health per the BLM Handbook H-4700-1 (USDI BLM 2010).

Indicators of Land Health

We evaluated land health using long-term upland, stream health and riparian monitoring information to determine ecological condition and trends. The long-term trend data indicate conditions on Forest Service and Bureau of Land Management allotments appear to be stable or moving towards desired conditions, with a few exceptions. A brief discussion of those few exceptions is included here, when there is indication that wild horses were a contributing factor, to help frame the tier 2 analysis. More complete information about the analysis to determine land health is in appendix A.

In the Forest Service Murderers Creek allotment, ecological plots for monitoring riparian condition indicate vegetation across the allotment has not changed substantially after 20 years. However, there are areas of concern due to high utilization rates and moderate soil disturbance in the Blue Ridge and Deer Creek pastures (Mellmann-Brown 2015).

The Bureau of Land Management conducts standards and guidelines assessments on grazing allotments to determine if the standards are being met (and if livestock grazing is conforming to the guidelines). If a standard is not being met they determine if there is progress towards the meeting of that standard and if livestock grazing is a contributing (or causal) factor. The 2003 standards and guidelines assessment conducted on the Soda Creek allotment determined all five standards were not

being met. In 2014, those same attributes were reevaluated and results indicated the allotment made significant progress toward, or was meeting, the standards due to changes in management.

In 2004, the standards and guidelines assessment conducted on the Big Baldy allotment showed all standards were being met except water quality standard 4. Wild horses were identified as a contributing factor to standard 4 not being met.

The 2004 standards and guidelines assessment conducted on the Rockpile allotment indicated standard 2 for riparian and wetland areas was not being met, but significant progress was being made. Standard 4 (water quality) was also not being met, and wild horses were identified as a contributing factor.

In 2014 and 2015, surveys (Groundwater Dependent Ecosystem Survey Level II) of Bureau of Land Management springs identified eleven springs as non-functional. Horses were identified as a causal factor.

Determining Cover and Space Sufficiency

Cover and space are both determined to be sufficient. There are no indications that cover and space are lacking in the joint management area. The diverse vegetation and topography provide shaded areas for cover in the summer as well as open south facing slopes that are preferred by horses in the winter. There are no reports of large numbers of wild horses leaving the area for thermal or hiding cover or because of lack of space. The joint management area is large enough and the topography diverse enough to accommodate seasonal migration patterns, with the horses moving to higher elevations in warm weather and to lower elevations in cold weather. Fences and waterways may have altered the seasonal migration patterns but that is not enough to make a determination of insufficiency for cover and space. There are no reports of the wild horses with body conditions indicating insufficient cover and space.

Information Used to Determine Cover and Space Sufficiency

The joint management area has a diverse amount of cover available for wild horses. The elevation ranges from 3,250 feet to almost 7,000 feet. There are areas of rolling to flat lands bisected by very steep rocky canyons and steep, timbered slopes bisected by relatively narrow stream channels. The vegetation in the joint management area is predominately coniferous (approximately 75 percent), with areas of dense canopy cover as well as areas with a more open canopy cover. The diverse vegetation and topography provide shaded areas for cover in the summer as well as open, south-facing slopes that are preferred by horses in the winter.

Crane and others (1997) found that horses move from lower to higher elevations in the summer and back to lower elevations in the winter where access to feed is less hampered by snow accumulation. Another study (Wockner et al. 2003) found that wild horses use low elevation, drier habitats during the winter and flatter areas with higher elevations, lower canopy cover, and proximity to water in the summer. The joint management area includes the habitat elements necessary to allow for this type of behavior. According to the 2007 plan written for the joint management area, the elevational migration of the bands of horses within the joint management area is relatively minor. Bands were observed in the upper elevations in mid-winter. The normal pattern is for the bands to move to the south slopes as winter progresses and to move back as spring approaches. It appears that within this joint management area the bands generally remain within a roughly defined territory throughout the seasonal migrations (USDA Forest Service, USDI BLM, Oregon Department of Fish and Wildlife 2007).

We also compared the existing fences and riparian corridors within the joint management area to the known horse locations (from census flights) to determine if the fences and waterways might be restricting horse use of the area, as displayed in Figure 6.

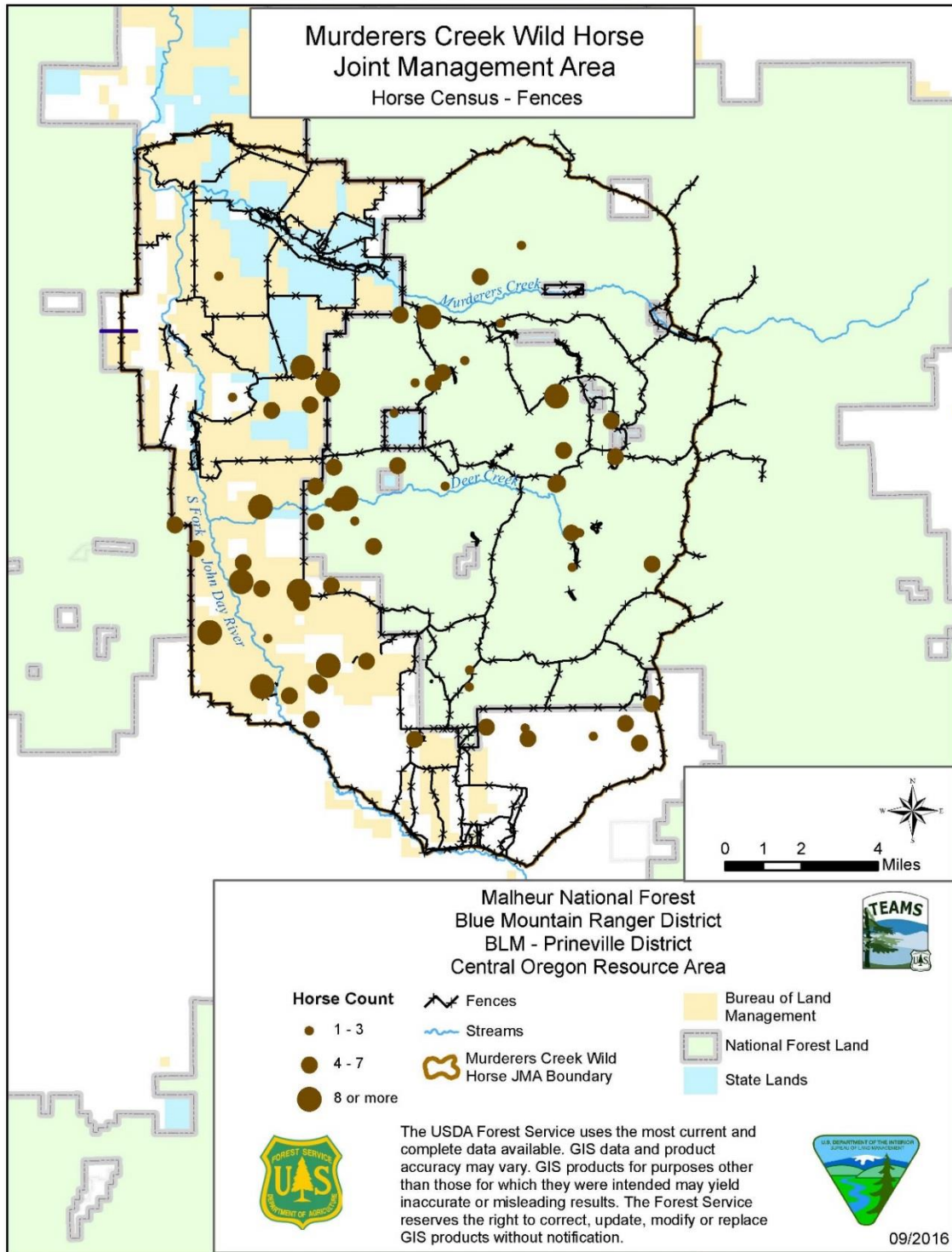


Figure 6. Fences and known wild horse locations within the JMA

There is no clear indications of restriction by the fences and riparian corridors. It does not appear the fences and large waterways are restricting horse use of the joint management area in a manner that reduces the space available to the horses. As new fences are planned in the future, they will be analyzed to identify possible restriction to horse movement. Gates are left open at the end of the livestock grazing season to accommodate horse movement, but it is possible horses could be enclosed with the livestock during the livestock grazing season.

The Bureau of Land Management Wild Horse and Burro handbook (USDI BLM 2010), tells us that a recurring pattern of wild horse movement out of a territory, to access forage, water, thermal or hiding cover, is an indication that the territory cannot sustain year-long wild horse use. There is no data for this joint management area indicating a recurring pattern of wild horse movement out of the territory to access forage, water, thermal or hiding cover. The files indicate wild horses have strayed outside of the delineated joint management area, but it is estimated that only 10 to 15 wild horses are occupying an area outside of the delineated joint management area (Ware 2011, as reported in Namitz 2012). This low number of horses moving outside the joint management area does not indicate that cover and space are insufficient. Likewise, horses moving out of the joint management area to take advantage of lush vegetation regrowth that may be occurring on recently burned areas, or conversely, moving out of the joint management area to avoid a fire is not an indication of lack of cover and space.

Tier 2 Analysis – Determining Appropriate Management Level

The tier 1 analysis determined that the four essential habitat components are sufficient, that the area is capable of supporting wild horses. In tier 2 we determine the appropriate management level. Based on the analysis detailed below, we are proposing an upper management level of 140 wild horses for the joint management area. A lower limit of 50 wild horses would allow the herd to grow to the upper limit over four to five years without removing excess wild horses in the interim.

In tier 2 we must consider the management objectives of the area. For this joint management area, that means ensuring progress is made toward achieving goals and objectives identified in the Malheur National Forest Land and Resource Management Plan, as amended (USDA Forest Service 1990) and the John Day Basin Record of Decision and Resource Management Plan (USDI BLM 2015). This includes meeting standards and guidelines for upland vegetation and riparian plant communities, watershed function, and habitat quality for animal populations, as well as other site-specific or landscape-level objectives, including those necessary to protect and manage threatened, endangered, Forest Service sensitive and BLM locally important species. In this particular joint management area we must consider the needs of the federally listed Middle Columbia River steelhead. The South Fork John Day River and several of its tributaries within the joint management area support the Middle Columbia River steelhead. There are 92.23 miles of designated critical habitat for the fish in the joint management area. Many of the management standards for this area are to protect this fish and its habitat. The applicable management direction is included in greater detail in appendix A.

The Bureau of Land Management handbook (BLM 2010) tells us when standards or objectives are not being met, and wild horse use is a contributing factor, the appropriate management level is established at a number below that which has contributed to the standards or objective not being met. In the next section we identify standards that were not met over the past several years and the estimated horse herd size for each year to understand how the herd size may be contributing to the standards not being met.

Limiting Factors

Our review of the substantial data available for this joint management area indicates that overall the upland conditions are meeting or moving towards management objectives (as discussed in the previous section). Yet, there were nine instances noted where the upland forage utilization standards were exceeded. Table 7 is a subset of Table 15, displaying only those years where the upland forage utilization standards were exceeded.

Table 7. Year and estimated wild horse herd size when upland forage utilization standards were exceeded

Year	Allotment/Pasture	Estimated wild horse herd size
2008	Murderers Creek/Frenchy Butte	460
2010	Murderers Creek/Deer Creek	231
2012	Murderers Creek/Horse Mountain Murderers Creek/Antelope Spring Murderers Creek/Blue Ridge	257
2013	Murderers Creek/Antelope Spring Murderers Creek/Frenchy Butte (on terraces)	no data for 2013, 2012 was 257, 2014 was 254
2015	Murderers Creek/Horse Mountain Murderers Creek/Antelope Spring	no data for 2015, 2014 was 245, 2016 was 317

We also know the livestock grazing in the area has been substantially reduced over the past several years as livestock were removed early or not allowed to graze in an area due to excessive use by wild horses and/or wildlife (as discussed in tier 1), so we are comfortable in assuming that horse use is at least partially, and in some cases wholly, responsible for these exceedances.

The riparian conditions have also been intensively monitored in the joint management area, with strict standards established to help meet the riparian management objectives. The effectiveness monitoring indicates that riparian and stream conditions are moving towards desired conditions, yet there are instances when standards were exceeded. Table 8 is a subset of the data displayed in table 19. It displays only the years the streambank alteration endpoints were exceeded, along with the estimated horse populations. In 2008, 2009, 2010, and 2011, there was no livestock grazing authorized in the locations where these end points were exceeded, which means the use is attributable to wild horses and wildlife.

Table 8. Year and estimated wild horse herd size when streambank alteration endpoints were exceeded

Year	Allotment/Pasture	Estimated wild horse herd size
2008	Murderers Creek/North Fork Deer Creek Murderers Creek/Deer Creek	460
2009	Murderers Creek/Blue Ridge	230
2010	Murderers Creek/Deer Creek	231
2011	Murderers Creek/John Young Meadows	238
2013	Murderers Creek/Deer Creek	no data, 2012 was 257, 2014 was 254
2014	Murderers Creek/John Young Meadows	254

On the lands administered by the Bureau of Land Management, we know that the rangeland health standards for riparian/wetland areas (standard 2) and water quality (standard 4) were not met on the Big Baldy and Rockpile allotments in 2004 (as discussed under *Standards for Rangeland Health*), and that horse use was identified as a contributing factor. The estimated wild horse herd size in 2004 was 193.

A survey of springs on Bureau of Land Management lands in 2014 and 2015 indicated that 13 of the springs surveyed are considered nonfunctional, 11 of them had indications that wild horse use was a causal or contributing factor, as displayed in Table 9. For the joint management area, a functional groundwater dependent ecosystem is generally one that maintains aquifer functionality, soil integrity and vegetation composition. A functional site usually had evidence of soil saturation or standing water sufficient to maintain hydric soils with no excessive erosion or compaction, and expected vegetation exhibited seasonally appropriate health and vigor. A nonfunctional site is generally depleted of aquifer recharge as indicated by upland plant species encroachment, or affected by groundwater extraction as indicated by changes in soil saturation or spring flow. The majority of nonfunctional sites have been heavily grazed by horses, livestock and/or wildlife, resulting in alteration of the soil structure from pedestals created by hoof shear and hoof compaction. Vegetation condition was also adversely affected by severe grazing and browsing, and may have decreased in diversity. The average estimated wild horse herd size in 2014 was 254, we do not have an estimate herd size for 2015, but we know in 2016 it was estimated at 317.

The wild horse census data indicate that approximately 50 percent of the horse herd occupy the lower elevations of Bureau of Land Management lands year round. This pattern of occupancy makes the springs more critical as water sources, and it subjects them to the possibility of excessive use as the herd size increases. During periods of drought, these springs may not be available, resulting in heavy use around the remaining water sources.

Table 9 Summary of springs that are nonfunctional with impacts from horses (from Appendix B - Hydrology Report)

Spring	Date	Condition – causal factor(s)
Dry Pine Creek	9/25/2014	Nonfunctional - horse
Ellingson Mill Spring 3	9/26/2014	Nonfunctional - horse
Dewey Creek	10/16/2014	Nonfunctional - horse, livestock and elk
Round Creek	10/17/2014	Nonfunctional - horse, livestock and elk
Soda Creek	10/21/2014	Nonfunctional - horse, livestock and elk
Unnamed Spring FSR 820	3/29/2015	Nonfunctional - horse, livestock and elk
Ellingson Mill Spring 4	7/12/2015	Nonfunctional - horse
Site 7	9/17/2015	Nonfunctional - horse
Dry Pine Creek 1	7/10/2015	Nonfunctional - horse
South Tributary Indian Creek	10/19/2014	Nonfunctional - horse, livestock and deer
North Tributary Indian Creek 2	10/14/2014	Nonfunctional - horse, livestock and deer

The information summarized above shows standards were exceeded, and horse use was identified as a contributing factor, in years when the estimated wild horse herd size ranged from 193 to 460. This indicates that the appropriate management level is below 193.

When determining the appropriate management level we must remember that wild horses are not a managed resource, they utilize the landscape year-round at varying levels given seasonal changes in the vegetation. We cannot control the timing, intensity, duration or distribution of their use as we can with livestock. The only tool available is to control the herd size which effectively reduces the overall impacts to the landscape. With this in mind, we must propose an upper limit that is sufficiently lower than 193 wild horses, in order to achieve multiple use objectives while maintaining a thriving natural ecological balance. This includes addressing the needs of federally listed Middle Columbia River steelhead.

In their biological opinion and associated take statement (NMFS 2013) the National Marine Fisheries Service concluded that the proposed action of implementing the 2007 Murderers Creek Wild Horse Territory/Herd Management Area Plan is not likely to jeopardize the continued existence of the Middle Columbia River steelhead or result in the destruction or adverse modification of their designated critical habitat. That management plan identified an appropriate management level of 50-140 horses. In their opinion the agency stated “*NMFS is certain that implementing the WHMP will cause take of MCR steelhead, and that wild horse population size is the best available extent of take indicator that is proportional to that amount of take*” (NMFS 2013). ‘Take’, as used here, is defined in the additional biological opinion discussion in appendix A.

The National Marine Fisheries Service also indicated that “*...an estimated population size of 140 individuals or more continuously over the entirety of any 24-month rolling period*” may result in take that is outside what they considered in the biological opinion (NMFS 2013). This conclusion suggests that a herd size in excess of 140 could produce excessive take and a corresponding change in the jeopardy decision.

We acknowledge that the biological opinion we refer to was issued for a proposed action that included an appropriate management level of 50 -140, and that should a different management level be proposed, consultation would be reinitiated for that new proposal. However, the existing biological opinion is the best information we have available to us. We believe it is prudent to acknowledge the expertise of National Marine Fisheries Service pertaining to the Middle Columbia River steelhead, including their conclusion that the proposed action of implementing the 2007 wild horse management plan, (which includes wild horse use of the territory and adjacent lands at an appropriate management level of 50-140) will result in take; that wild horse herd size is the best indicator of the extent of that take; that at an upper level of 140 the amount of take anticipated is not likely to jeopardize the continued existence of the fish; and that a herd size in excess of 140 could result in excessive take.

The failure to meet the standards discussed above indicate the upper level of the appropriate management level must lower than 193, and it must be far enough below 193 to prevent failure to meet the standards. When we couple this with the opinion that a herd size of 140 is not likely to jeopardize the continued existence of the federally listed fish, we must recommend an upper limit of 140 for the appropriate management level for this joint management area.

The lower limit of 50 horses was calculated by considering the estimated annual growth rate of the herd and set at a level that allows the herd to grow to the upper limit over four to five years without removing excess wild horses in the interim.

Tier 3 Analysis

In tier 3, we determine if the appropriate management level of 50 to 140 wild horses is sufficient to maintain genetic diversity in the joint management area. Our determination, based on the discussion

below, is that management actions to maintain genetic variability should be included in the joint management area plan.

The Bureau of Land Management handbook recommends a minimum herd size of 150 to 200 horses (at least 50 effective breeding animals) to avoid inbreeding depression in wild horse populations, and states that interchange of horses between other herd management areas or territories may reduce the need to maintain a herd of that size (USDI BLM 2010). The 2013 National Academy of Science committee review (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013) stated in order to maintain herd fitness, that figure could be closer to 5,000. This is based on the following: 1) new genetic variation from mutations is added more slowly than originally thought, 2) the effects of inbreeding depression are likely to be more severe in stressful environments, and 3) slightly deleterious mutations may accumulate in smaller populations and lead to a decline in fitness. The committee acknowledged that managing for a minimum of 5,000 animals would not be realistic, that assisted movement of individual horses between herd management areas will be necessary, and that herd management areas will need to be managed as a metapopulation for long-term persistence at the herd management area level. There is evidence of similarity of the genetics between the Murderers Creek herd and horses in other herd management areas in Oregon.

Genetic analyses of the horses occupying the joint management area have been conducted repeatedly by Dr. Cothran at Texas A&M University over the past several years (Cothran 2001, 2008, 2010 and 2013). These reports include information from samples collected in 2001, 2005 (documented in the 2008 report), 2009 and 2013. In his latest genetic analysis (2013) of the Murderers Creek herd, Dr. Cothran noted the following: this is a herd with mixed origins, with no clear indication of primary breed type; no variants were observed which have not been seen in horse breeds; and both observed heterozygosity and expected heterozygosity in the herd is below the feral mean. He determined that the existing herd is in genetic equilibrium with no clear evidence of gene flow into the herd. However, the tests he conducted on this herd in 2001 and 2009 (documented in the 2010 report) indicated that there was possible gene flow into the herd between 2001 and 2009. His examination of genetic variability indicated current variability levels are high enough that no action is needed at this point. However, he recommended the herd be monitored closely due to the high proportion of rare alleles (Cothran 2013).

Based on the both the National Academy of Science recommendation, which is applicable to all wild horse and burro management, and on Dr. Cothran's recommendation, which is specific to this joint management area, we recommend that the genetics of the herd continue to be monitored, and that the proposed action for the joint management area include actions that will be taken to ensure genetic variability is maintained. Per the BLM handbook (USDI BLM 2010), these possible management actions could include:

- Maximize the number of breeding age horses in the herd (animals age 6 to 10 years). This could increase the need for removal to keep the herd size at 50 to 140 horses.
- Introduce one or two young mares from outside the joint management area every generation (about every 10 years). Introduced animals should come from herds living in similar conditions.

Proposed Appropriate Management Level

Based on the above analysis, we propose an appropriate management level for the Murderers Creek Wild Horse Joint Management Area of 50 to 140 wild horses. This is consistent with the appropriate

management level currently established in the John Day Basin Record of Decision and Resource Management Plan and would refine the ambiguous “average of 100 head” identified in the Malheur Forest Plan to a clearly established upper and lower limit.

In tier 1, we determined the four essential habitat components – water, forage, cover and space – are sufficient in the joint management area. Water is not a limiting factor. There is abundant water available to wild horses even with miles of Middle Columbia River steelhead habitat fenced to restrict access to perennial streams. The forage component is also sufficient in the joint management area. We determined this by calculating the forage available in the joint management area; disclosing the current obligations to wild horses, livestock, and wildlife; and examining utilization monitoring data and land health indications. The joint management area is large enough and vegetation and topography diverse enough to provide sufficient cover and space for the wild horses. Wild horses are not leaving the joint management area in large numbers to meet their need for cover and space.

In the tier 2 analysis, we determined that management constraints, including Forest Plan and Resource Management Plan direction, Bureau of Land Management standards for rangeland health, and protection for the threatened Middle Columbia River steelhead and their habitat, indicate the appropriate upper limit is 140 wild horses. The lower limit was set at a number that would allow the herd to grow over a four to five year period without the need for removing excess wild horses in the interim.

In tier 3, we determined that management actions to ensure herd fitness will be needed at some point. The most recent genetic analysis of the wild horses in the joint management area indicates current variability levels are high enough that no action is needed at this point, but genetic monitoring should be continued. We recommend that the genetic monitoring of the herd continue and that the management plan for the area include actions that will be taken to ensure genetic variability is maintained.

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Appendix A – Supporting Documentation for the Analysis

Tier 1 Analysis – Additional Information

Information Used to Determine Forage Sufficiency

Information Used to Calculate Forage Production

In 1983, an extensive production and utilization study was conducted within the Forest Service portion of the joint management area to look at the amount of forage available. That analysis involved an in-depth look at the amount of forage available and forage use by livestock, wild horses, and wildlife. It determined no significant problems with proper use of forage would be expected given 100 head of horses, the natural elevation, seasonal migration, and the scattered territoriality of the bands. Use by all species was well within the allowable use levels and the needs of all resources involved were being met. The 1983 study determined livestock were the dominant forage users, accounting for 57 to 74 percent of use. Wildlife use occurred mostly in the spring and fall and was inversely related to livestock use. Horse use accounted for 13 to 18 percent of the use, with no apparent relationship to livestock. Most pre-livestock use was in the 0 to 5 percent range; however, there were some locations with 10 to 20 percent use, likely attributable to horses (USDA Forest Service 1983).

Because each agency has different types of data available the sources of information for the tier 1 analysis varied slightly. On Forest Service lands, we used the spatial plant community type data and the corresponding herbage estimates found in Plant Associations of the Blue and Ochoco Mountains (Johnson and Clausnitzer 1992), Mid-Montane Wetland Plant Associations of the Malheur, Umatilla and Wallowa-Whitman National Forests (Crowe and Clausnitzer 1997) and Pacific Northwest Ecoclass Codes for Seral And Potential Natural Communities (Hall 1998). These publications identify an estimated range of herbage production values that were then refined for the local area.

For the Bureau of Land Management lands, we used the spatial ecological site typing data and data from the corresponding ecological site descriptions. We combined that data with the soil vegetation inventory method data to refine the estimated production and provide site specificity.

For both agencies whenever a production value was listed as a range of numbers we used the lowest number because the handbook directs us to use the most limited forage production years to prevent overestimation. We believe this to be the best data available for lands managed by both agencies, and we also acknowledge it is difficult to accurately estimate forage production based on vegetation type due to the many variables involved in forage production - fluctuating climatic conditions, site changes such as juniper encroachment or invasive grass infestations that may have increased since the data were collected, timber management and fires can all affect the amount of forage produced. Because of the uncertainty inherent in calculating forage production based on vegetation type, it is important to note that this is only the beginning step of this analysis.

Information Used to Estimate Horse Herd Size

The reports of the estimated horse herd size and the number of horses removed indicate that it has been difficult to get an accurate count of horses in the joint management area since establishment. The first plan for the area, written in 1974, estimated the herd size at 100 animals and stated there was a balance between recruitment and losses for the previous 10 years (USDA Forest Service 1974). However, in 1975,

174 horses were observed (USDA Forest Service USDI BLM 1975), and by 1976, the herd size was estimated at 200 horses (USDA Forest Service 1976). The 1984 plan (USDA Forest Service 1984) stated that in 1979 the herd size estimate was 197 and 117 horses were removed, leaving 80 horses. Yet in 1980, 110 horses were counted – more than could be credited to annual recruitment.

Since 2012, the Forest Service and Bureau of Land Management have been using a new census protocol with an emphasis on reducing the percentage of error. In 2014 and 2016, counts were conducted for the joint management area using simultaneous double-count aerial surveys. Those data were analyzed to estimate sighting probabilities and the raw counts were corrected for systemic biases (undercounts) that are known to occur in aerial surveys. Because the data were collected using the same protocol and subjected to the same statistical analyses, the estimates are comparable, reducing some of the uncertainty. The estimate for 2014 was refined in 2016 by using the pooled data from both years to estimate sighting probabilities, which was then used to correct the raw counts for systematic biases (Lubow 2016). Future counts conducted with the same protocols and subjected to the same statistical analysis will help reduce the uncertainty associated with the wild horse population size in the joint management area. While we acknowledge it has been difficult to obtain accurate counts in the past and it is likely the herd size has been underestimated, we must use those estimates in this analysis, as they are the best data available.

Information Used for Permitted Livestock Use

Forest Service allotments are Murderers Creek, Rosebud, Poison and Frenchy and the Tamarack pasture of the Snowshoe allotment. The Frenchy allotment is administered by the Bureau of Land Management as part of the Big Baldy allotment. Bureau of Land Management allotment names and allotment numbers are Big Baldy 4052, Big Flats 4186, Murderers Creek 4020, Rockpile 4403, Soda Creek 4044, Morgan Creek 4154, Mahogany 4043, Corral Gulch 4164, and Cow Creek 4352.

Permitted livestock use and forage needs are shown in table 10. Authorized livestock use is summarized in table 11. Please note the numbers in the Table 10 are based on the numbers of livestock identified on the term grazing permits (Forest Service) and the preference (Bureau of Land Management) numbers, not the actual number authorized to graze each year. Table 11 displays the average actual use for each allotment; those figures are a more accurate indication of the authorized grazing that has occurred over the past several years. We are using pounds of forage rather than animal unit months based on the recommendation from the National Academy of Science committee review (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013). Likewise, we use head months rather than animal unit months to display the number of livestock and permitted or leased tenure, one head month is one head of livestock for one month. Forest Service permits are issued for head months; Bureau of Land Management preference numbers are expressed as animal unit months. Because the Bureau of Land Management uses an animal unit equivalent of 1.0 for a cow-calf pair, one head month is equivalent to one animal unit months for the Bureau of Land Management allotments.

Table 10. Forage needs of permitted/leased livestock grazing in the joint management area (JMA)

Allotment	Number of head permitted or leased	Season of use	Permitted or leased head months on allotment (number of head × months)	Pounds of forage needed to support permitted or leased livestock within JMA*
Murderers Creek	400 c/c	7/1-10/15	1,407	3,561,000
	4 horse	5/15-10/30	22	
	200 c/c	6/1-6/30	197	
	300 c/c	7/1-10/15	1,055	
	175 c/c	5/16 – 10/15	880	
			Total 3,561	

Allotment	Number of head permitted or leased	Season of use	Permitted or leased head months on allotment (number of head × months)	Pounds of forage needed to support permitted or leased livestock within JMA*
Rosebud	82 c/c	6/1 – 9/20	302	302,000
Poison on/off	2 c/c	5/1-9/30	10	10,000
Snowshoe	100 c/c	6/1-10/5	418	418,000
Frenchy on/off	18 c/c	4/15-5/31	28	28,000
Pounds of forage needed for all Forest Service permitted grazing				4,319,000
Murderers Creek 4020	139 c/c	5/1-10/30	838	838,000
Mahogany 4043	8 c/c	4/1-11/30	64	64,000
Soda Creek 4044	50 c/c	4/1-11/30	405	405,000
Big Baldy 4052	322	4/15-5/31	498	498,000
Rockpile 4103	116	4/1-11/30	928	928,000
Morgan Creek 4154	36	4/1-11/30	290	290,000
Corral Gulch 4164	211	5/1-6/15	318	318,000
Big Flats 4186	16	4/15-11/30	100	100,000
Cow Creek 4352	16	4/1-11/30	10	10,000
Pounds of forage needed for all BLM leased grazing				3,451,000

* Based on consumption rate of 1,000 pounds of forage for one cow/calf pair per month.

The authorized grazing and actual use of the area has been lower than the permitted and leased numbers over the past several years on several allotments. For example, authorized grazing on the Murderers Creek allotment was below the permitted numbers prior to 2007. Since 2007, there have been 2 years of non-use where no grazing was authorized and a reduced amount of grazing for all other years. As discussed below in the *Riparian Utilization* section, much of this reduction has been to meet utilization standards developed to protect the federally listed Middle Columbia River steelhead.

The Forest Plan provides conservation benefits to the Middle Columbia River steelhead and its designated critical habitat by directing that the needs of other resources will be met by the Malheur National Forest range program. In the biological assessment completed for the 2007 Murderers Creek Wild Horse Territory/Herd Management Area Management Plan, the author states:

“The Murderers Creek allotment is entirely within the Territory and is the largest component of the Territory by land area. Livestock and big game use in the allotment is secondary to maintaining a wild horse herd averaging 100 head pursuant to plan direction. This means that livestock will not be allowed to turnout in a specific pasture when pre-season monitoring indicates that use by wild horses and big game are close to or exceed a grazing endpoint” (Namitz 2012).

Table 11. Actual use by authorized livestock grazing in the joint management area (JMA)

Allotment	Average actual use head months on allotment (number of head × months)*	Pounds of forage utilized by authorized livestock on allotments within JMA**
Murderers Creek	788	788,000
Rosebud	212	212,000
Poison on/off	10	10,000
Snowshoe	330	330,000
Frenchy on/off	20	20,000
Estimated pounds of forage utilized by livestock for all Forest Service authorized grazing		1,360,000
Murderers Creek 4020	625	625,000
Mahogany 4043	303	303,000
Soda Creek 4044	135	135,000
Big Baldy 4052	390	390,000
Rockpile 4103	867	867,000
Morgan Creek 4154	55	55,000
Corral Gulch 4164	315	315,000
Big Flats 4186	58	58,000
Cow Creek 4352	87	87,000
Estimated pounds of forage utilized by livestock for all BLM leased grazing		2,835,000

*Forest Service allotments include grazing years 2007-2015; BLM allotments include 2008-2012

**Based on consumption rate of 1,000 pounds of forage for one cow/calf pair per month.

Information about Elk and Deer Populations in the Joint Management Area

Table 12 displays the Rocky Mountain elk and mule deer management objectives and population estimates from 2004-2015 for the Murderers Creek and Ochoco wildlife management units in Oregon. The mule deer population management objective was obtained from Oregon Department of Fish and Wildlife (2003), available online at:

http://www.dfw.state.or.us/wildlife/management_plans/docs/MuleDeerPlanFinal.PDF.

Oregon Department of Fish and Wildlife biologist Ryan Torland (pers. comm. 2015, 2016) provided information for the Murderers Creek wildlife management unit for mule deer population estimates, Rocky Mountain elk management objectives and Rocky Mountain elk population estimates. The same information for the Ochoco wildlife management unit was provided by Oregon Department of Fish and Wildlife biologist Greg Jackle (pers. comm. 2016).

Table 12. Rocky Mountain elk and mule deer management objectives and winter population estimates from 2004-2014 for the Murderers Creek and Ochoco Wildlife Management Units in Oregon.

Year	Murderers Creek Wildlife Management Unit				Ochoco Wildlife Management Unit			
	Elk Mgmt. Objective = 1,700	% of Mgmt Obj.	Deer Mgmt. Objective = 9,000	% of Mgmt Obj.	Elk Mgmt. Objective = 4,500	% of Mgmt Obj.	Deer Mgmt. Objective = 20,500	% of Mgmt Obj.
2004	1,700	100	6,695	74	4,500	100	17,000	83

Year	Murderers Creek Wildlife Management Unit				Ochoco Wildlife Management Unit			
	Elk Mgmt. Objective = 1,700	% of Mgmt Obj.	Deer Mgmt. Objective = 9,000	% of Mgmt Obj.	Elk Mgmt. Objective = 4,500	% of Mgmt Obj.	Deer Mgmt. Objective = 20,500	% of Mgmt Obj.
2005	1,800	106	6,968	77	4,000	89	17,000	83
2006	1,800	106	6,820	76	4,600	102	16,500	80
2007	2,273	134	5,207	58	4,700	104	16,500	80
2008	1,900	112	6,820	76	4,300	96	15,700	77
2009	1,900	112	6,968	77	4,000	89	15,500	76
2010	1,900	112	6,695	74	4,300	96	16,000	78
2011	1,900	112	5,904	66	3,900	87	15,400	75
2012	1,900	112	5,303	59	4,032	90	15,400	75
2013	1,900	112	5,699	63	4,000	89	15,000	73
2014	1,900	112	6,009	67	4,200	93	14,800	72
2015	1,900	112	6,244	69	4,050	90	15,000	73

To determine the amount of forage needed for deer and elk we used the animal unit factors of 0.20 for mule deer and 0.60 for elk (Pratt and Rasmussen 2001), which equate to 5.2 pounds of forage daily for mule deer and 15.6 pounds of forage daily for elk.

Only portions of the Murderers Creek and Ochoco wildlife management units are within the joint management area, 18 percent of the Murderers Creek unit, and 1.1 percent of the Ochoco unit. Because it is unlikely that all of the animals in these larger wildlife management units are utilizing the joint management area, we prorated the forage needs based on the amount of the wildlife management unit that is within the joint management area.

We acknowledge that the forage needs and the actual use of mule deer and elk within the joint management area changes throughout the year. For example, we know that deer and elk use of the area within the joint management area is limited outside of the winter use period (identified as December 1 through May 1), although there are some resident ungulates that stay within the area year round (Marvin pers. comm. 2015). Lacking more precise use information, we will display the needs based on a yearly total, rather than just for the winter months, to ensure we do not underestimate the forage needs. It must also be acknowledged that the values for “number of animals within the JMA” are very rough estimates because they are based on the assumption that the forage capacity of every acre of wildlife management unit is equal (i.e., 1.1 percent of the Ochoco Wildlife management unit is within the joint management area; therefore, the joint management area needs to produce 1.1 percent of the needed forage). Our estimate here is simply an attempt to display, in a quantifiable manner, the forage needs of mule deer and elk within the joint management area. The calculations for both wildlife management units are displayed in Table 13.

Table 13. Forage needs of wildlife at 2015 management objective level in the joint management area, in the Murderers Creek and Ochoco wildlife management units

	2015 management objective, number of animals	% of wildlife management unit within the JMA	Prorated 2015 management objective, number of animals within JMA	Yearly forage consumption, pounds of forage per animal	Pounds of forage needed to support animals at the management objective within the JMA
Murderers Creek Wildlife Management Unit Mule Deer	9,000	18%	$9,000 \times .18 = 1,620$	1,898	3,074,760
Murderers Creek Wildlife Management Unit Elk	1,700	18%	$1,700 \times .18 = 306$	5,694	1,742,364
Ochoco Wildlife Management Unit Mule Deer	20,500	1.1%	$20,500 \times .011 = 226$	1,898	427,999
Ochoco Wildlife Management Unit Elk	4,500	1.1%	$4,500 \times .011 = 50$	5,694	281,853
Total pounds of forage needed for elk and deer within the JMA – both wildlife management units					5,526,976

Just as the authorized amount of livestock grazing has differed from the permitted or leased livestock use over the last several years, the actual number of deer and elk has varied from the management objectives for the past several years. Table 14 displays the estimated actual use for mule deer and elk based on the population estimates. Again, we prorated the numbers based on the amount of the wildlife management unit that is within the joint management area. The estimated actual use by elk and mule deer, in the joint management area is calculated as 4,680,109 pounds of forage.

Table 14. Deer and elk actual use estimates, based on population estimates

	Average population estimate 2004-2015	% of wildlife management unit within the JMA	Prorated average population, number of animals within JMA	Yearly forage consumption, pounds of forage per animal	Pounds of forage needed to support animals within the JMA at estimated population levels
Murderers Creek Wildlife Management Unit Mule Deer	6,278	18%	$6,278 \times .18 = 1,130$	1,898	2,144,702
Murderers Creek Wildlife Management Unit Elk	1,898	18%	$1,898 \times .18 = 342$	5,694	1,945,042
Ochoco Wildlife Management Unit Mule Deer	15,709	1.1%	$15,709 \times .011 = 173$	1,898	327,974
Ochoco Wildlife Management Unit Elk	4,189	1.1%	$4,189 \times .011 = 46$	5,694	262,391
Total pounds of forage needed for elk and deer within the JMA – both wildlife management units					4,680,109

Information Used for Utilization Monitoring

Utilization data includes data collected from upland sites (Landscape Appearance, Key Species Utilization, and Utilization Mapping protocols), as well as stubble height measurements, woody browse use and streambank alteration measurements in riparian areas.

Upland Utilization

For grazing allotments administered by the Forest Service, we considered upland utilization data from 2006 through 2015. Table 15, table 16, and table 17 display a summary of the available forage utilization data for the Forest Service allotments, any pasture or allotment that is not included in the table either had non-use (grazing rest) for the years displayed or the unit was not monitored. Non-use is used here to mean livestock grazing was not authorized on an allotment or pasture during a particular year. Utilization monitoring usually does not occur on a pasture if it is not grazed; however, there are a few instances noted in the tables where utilization data were gathered even though no livestock grazing was authorized. The use recorded on those pastures is attributable to wild horse and wildlife use. The use recorded for years when livestock grazing was authorized includes use from livestock, wildlife, and wild horses. The data for 2007 includes monitoring conducted by the grazing permittee; it is shown in the tables as “permittee

monitoring”. The references to standards being met or exceeded for 2006 and 2007 are referring to the following direction from the Forest Plan (USDA Forest Service 1990):

... annual forage utilization requirements will be established in each allotment management plan as a tool to achieve or maintain the desired condition. The annual use of available forage on allotments in a satisfactory condition will be 45% on forested lands; 55% on grasslands; and 50% on shrublands. On allotments in an unsatisfactory condition the annual use of available forage will range from 0 to 35% on forested lands and grasslands; and 0 to 30% on shrublands. (Forest-wide Standard 87, Table IV-2, Forest Plan pg IV-35).

Table 15. Summary of average upland forage utilization (cattle, horse, and wildlife) for the Murderers Creek allotment 2006–2015

Pasture	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Horse Mtn	preseason monitoring – use exceeds standard	light to none permittee monitoring 2-27%	non-use	non-use	-	non-use	48%	43%	43%	48%
Antelope Spring	-	-	non-use	-	-	non-use	50%	53%	burned	non-use 70%**
Timber Mtn	-	standards met, light utilization permittee monitoring 2-27%	non-use	26%	35%	non-use	30%	26%	burned	10%**
Frenzy Butte	-	standards met at key areas permittee monitoring 2-15%	non-use 86%	-	30%	non-use	non-use	42% 77% on terraces	34%	30%
Deer Creek	preseason monitoring – use exceeds standard	standards met at key areas permittee monitoring 5-20%	non-use 38%	non-use	48%	non-use	light use	15%	38%	32%
John Young Meadow	-	standards met at key areas – moderate use permittee monitoring 10%	non-use	-	-	non-use	non-use	33%	30%	20%
John Young Meadow Cow Camp	-	-	non-use	-	-	non-use	23%	10%	15%	20%
Blue Ridge	preseason monitoring – use exceeds standard	heavy use – standard exceeded in key area, light outside of key area permittee monitoring 2-15%	non-use	non-use	30%	non-use	52%	40%	42%	33%
Dans Creek	-	above standard (uplands light use but drainages and bottoms heavy use) permittee monitoring 10-35%	non-use 30%	non-use	non-use	non-use	non-use	non-use	non-use	27%**
Oregon Mine	non-use	non-use	non-use	non-use	non-use	non-use	non-use	non-use	burned	3%**

Table 16. Summary of average upland forage utilization (cattle, horse, and wildlife) for the Snowshoe allotment 2006–2015

Pasture	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Lewis Creek/Johnnie Creek	standards met	< 40%	5%	41%	-	30%	-	-	-	-
Lower Hog/Upper Hog Creek	standards met	< 40%	21%	31%	-	30%	-	15%	-	-
Summit	standards met	< 40%	35%	34%	-	30%	38%	-	-	-
Tamarack	standards met	< 40%	30%	28%	-	30%	-	-	-	-
Snowshoe	standards met	< 40%	0-5%	6%	-	30%	-	-	-	-
Little Snowshoe	standards met	< 40%	0-5%	very little use	-	30%	-	-	-	-

Table 17. Summary of average upland forage utilization (cattle, horse, and wildlife) for the Rosebud/Poison allotments 2006–2015

Pasture	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Camp Faraway	standards met	40%	46%	-	-	40%	-	-	-	-
Morgan Creek	standards met	light	30%	-	-	40%	-	67%	22%	-
Capps Creek	standards met	30%	46%	-	-	non-use	45%	-	-	-
Rosebud	standards met	20%	18%	-	-	non-use	-	-	-	-

For the allotments administered by the Bureau of Land Management, we have utilization data ranging intermittently for 1987 through 2014. The level of utilization recorded includes use from livestock, wildlife, and wild horses. Overall, the utilization data show mostly light and moderate use, with only a few areas of heavy (61-80 percent) use. Table 18 displays the summary of the most recent data collected from multiple points across the allotment or pasture. Data in table 18 were collected using the landscape appearance protocol, at the end of the grazing season. Data for previous years are available in spreadsheet form in the project record.

Table 18. Summary of forage utilization for the BLM allotments 2013 and 2014

Allotment - Pasture	2013	2014
Big Baldy - North	7 percent	area burned, data not collected
Big Baldy - South	15 percent	27 percent
Big Flats - Spring	3 percent	9 percent
Soda Creek - Snake Den	4 percent	9 percent
Soda Creek - Wildcat	3 percent	11 percent
Morgan Creek - North	not collected	21 percent

We also have utilization mapping for the Bureau of Land Management allotments intermittently from 1987 to 2013, the most recent of which is displayed in Figure 7. The spatial data associated with the 2013 mapping show there are eight relatively concentrated areas of heavy use. Those areas are less than 1 percent of the total area mapped and are associated with springs.

Overall in 2013, utilization was measured as 0 to 5 percent on 45 percent of the area, 6 to 20 percent on 50 percent of the area and greater than 20 percent on only 4 percent of the area. An examination of all the available data (ranging from 1987 to 2014) shows a great majority of the area managed by the Bureau of Land Management has received less than 41 percent use, with very few acres recorded in the 61 to 80 percent use category.

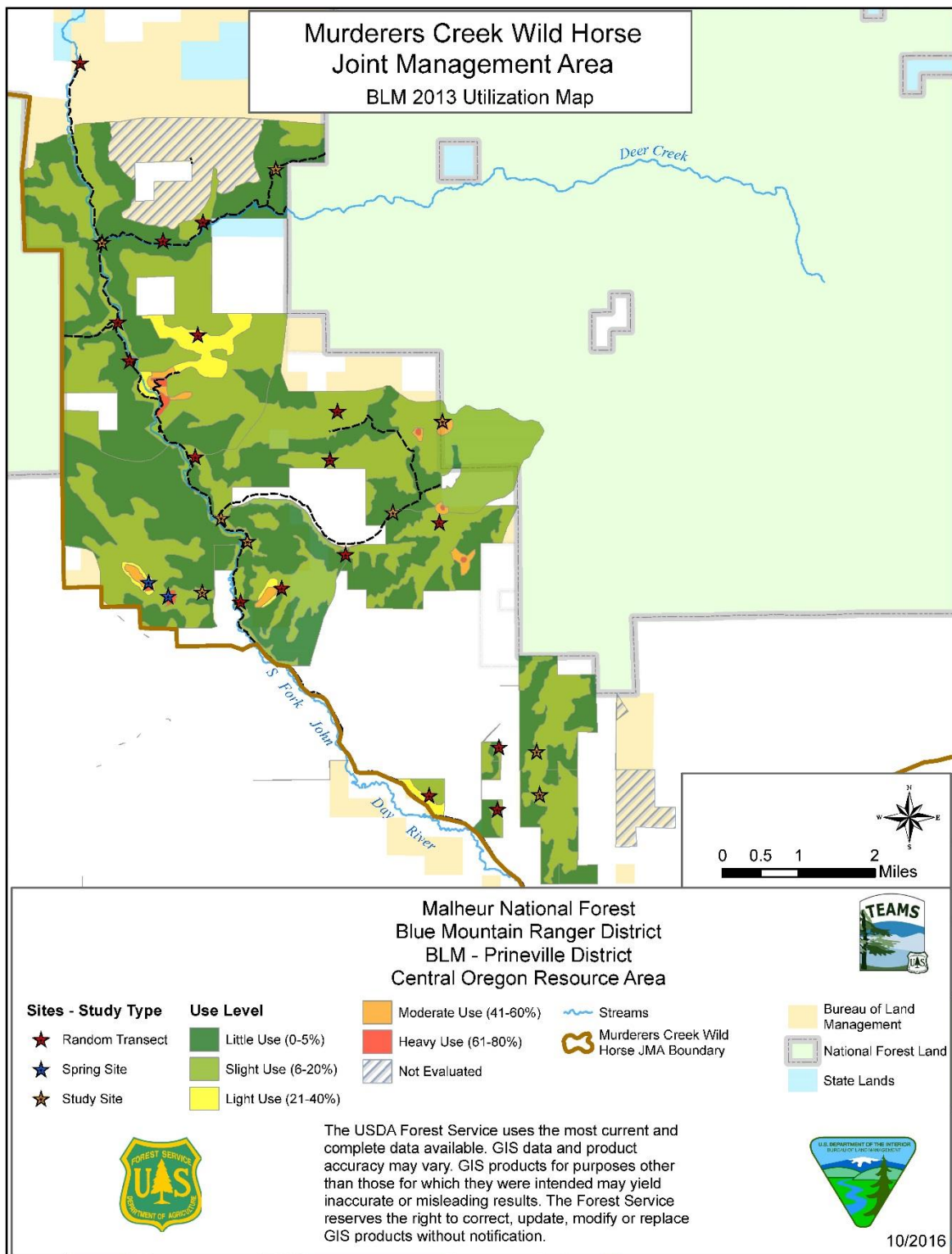


Figure 7. Utilization mapping conducted on BLM allotments, 2013, use is attributable to livestock, wild horses and wildlife

Riparian Monitoring

The Malheur National Forest has a riparian monitoring strategy to determine the condition and trend of riparian ecosystems. That strategy includes extensive monitoring which occurs pre-grazing, during the grazing season, and post-grazing. Key components of the riparian monitoring strategy are as follows:

1. Information Gathering and Interpretation

- ◆ Proper functioning condition assessment –qualitative condition assessment over a stream reach (geomorphic or unit-specific)
- ◆ Multiple indicator monitoring – quantitative monitoring protocol at designated monitoring areas
- ◆ Analysis – interpretation and evaluation of assessment and monitoring information to determine current riparian condition and, to the extent feasible, trend
- ◆ Channel cross-section, streambed particle size distribution, and reach description measurements (i.e. Rosgen channel type)
- ◆ Forest Service Region 6 level 2 stream inventory surveys – extensive quantitative assessment of stream channel, riparian vegetation, aquatic habitat condition, and biota to determine condition of selected stream systems
- ◆ Spawning surveys – quantitative assessment of redd vulnerability to disturbance

2. Support determinations of plan compliance – Provide information for assessing compliance with Forest Plan, including PACFISH and INFISH amendments.

- ◆ Standards are GM 1-4 in PACFISH and INFISH; standards 15 through 21 in Forest Plan.
- ◆ Management objectives for stream and riparian areas are described in PACFISH and INFISH amendments (riparian management objectives) and in Amendment 29 of the Forest Plan for Management Area 3A/B (desired future conditions).

3. Recommendations

- ◆ Shows linkage between condition, trend, and past/current management activities
 - A process that provides support for grazing management decisions or any necessary or appropriate adaptive management adjustments
 - Allows annual adjustment of management strategies, as needed, to achieve compliance with plan direction

Three indicators in the multiple indicator monitoring protocol are tools that monitor utilization: streambank alteration, stubble height, and woody browse use. Each has an end point standard and a move trigger. Selected end points, if not exceeded, will allow attainment of, or reasonable progress toward, desired conditions for riparian areas and fish habitat as described in section 3 of the Forest Plan.

The ranges of values are starting points based on research and the best collective professional judgment for establishing desired riparian conditions. To the extent feasible, end point indicators (allowable use in riparian areas) are site specifically designed to prevent carry-over effects.

The move trigger is the amount of use that indicates livestock are to be moved from the pasture or allotment. Move triggers are designed to prevent the end point standard from being exceeded. Table 19 displays a summary of monitoring results for streambank alteration, stubble height, and woody browse use over the past several years. Measurements that exceeded the standards are shown in red font. In 2008

and 2011, no livestock grazing was authorized in the area monitored, and in 2010 only the Timber Mountain and John Young Meadows pastures were grazed, the latter only four days. Use shown for those years is attributable to wild horses and wildlife. The standards for the monitoring sites include in Table 19 are as follows:

- Streambank alteration - 10% (2007-2011); after 2011 - 15% end point, 10% move trigger
- Stubble height - 4" early season, 6" late season end point; move triggers 5" and 7", respectively
- Woody browse use - 50% early season, 40% late season endpoint; move triggers 40% and 30%, respectively

Table 19. Summary of the streambank alteration, stubble height and woody browse use indicators – Forest Service

Location and Indicators Monitored	2005*	2007	2008**	2009	2010	2011**	2012	2013	2014	2015
Murderer's Creek Allotment - Thorn Creek PIBO (PACFISH/INFISH biological opinions) Integrator Site (Martin Corrals Pasture)										
Bank Alteration (%)			5**							
Stubble Height (inches)			18**							
Woody Browse (%)			7**							
Murderer's Creek Allotment - Thorn Creek DMA Site (Martin Corrals Pasture)										
Bank Alteration (%)			0**							
Stubble Height (inches)			12**							
Woody Browse (%)			5**							
Murderers Creek Allotment - Murderers Creek Forest MIM DMA (Murderers Creek Holding Pasture)										
Bank Alteration (%)		8	2**							
Stubble Height (inches)		12	18**							
Woody Browse (%)		18	6**							
Murderer's Creek Allotment - North Fork Deer Creek Forest MIM DMA (North Fork Deer Creek Pasture)										
Bank Alteration (%)		7	15**	3**	1				1	
Stubble Height (inches)		12	12**	14**	15				15	
Woody Browse (%)		20	6**	0-40**	10				90	
Murderer's Creek Allotment - Deer Creek DMA #2 (Deer Creek Pasture)										
Bank Alteration (%)	20	10	13**	10**	11	13**		20	8	5
Stubble Height (inches)	14	8	14**	17**	12			10	9	8
Woody Browse (%)	25	20	11**	0-40**	8			10	7	10
Murderer's Creek Allotment - Deer Creek Forest MIM DMA (Frenchy Butte Pasture)										
Bank Alteration (%)	8	14	4**	8**	6			14	12	14
Stubble Height (inches)	12	8	11**	14**				4	8	11
Woody Browse (%)	6	18	7**	< 20**				13	14	36
Murderer's Creek Allotment - South Fork Murderers Creek Forest MIM DMA (John Young Meadows Pasture)										
Bank Alteration (%)	8	14	4**	3	6	19**		12	17	14
Stubble Height (inches)	18	16	16**	18	20			14	12	18
Woody Browse (%)	7	35	8**	< 20	8			46	32	33
Murderer's Creek Allotment - Blue Ridge Pasture										

Location and Indicators Monitored	2005*	2007	2008**	2009	2010	2011**	2012	2013	2014	2015
Bank Alteration (%)				20**			29			
Stubble Height (inches)							4			
Woody Browse (%)										

*no data for 2006, blank cells indicate no data reported because the pasture was rested or not monitored

**no livestock grazing authorized, use is from wildlife and wild horses only

For the lands administrated by the Bureau of Land Management we have bank alteration, stubble height, and woody browse data for four sites in 2015, as displayed in table 20.

Table 20. Summary of streambank alteration, stubble height and woody browse use indicators for 2015 – BLM

Bureau of Land Management Site 510-17-1	
Bank Alteration (%)	0.53
Stubble Height (inches)	19
Woody Browse (%)	8
Bureau of Land Management Site 510-18-1	
Bank Alteration (%)	0.16
Stubble Height (inches)	13
Woody Browse (%)	0.4
Bureau of Land Management Site 510-19-1	
Bank Alteration (%)	0
Stubble Height (inches)	17
Woody Browse (%)	4
Bureau of Land Management Site 510-21-1	
Bank Alteration (%)	0.17
Stubble Height (inches)	22
Woody Browse (%)	2

Information Used to Evaluate Land Health

Forest Service Administered Allotments

Long-term Trend Monitoring Plots

There are 24 long-term trend monitoring plots established across the joint management area, on lands managed by the Forest Service (Figure 8). Some plots were established in the 1950s and early 1960s using the Parker three-step condition and trend protocol, and some were recently established using the line point protocol.

Over the past several years the historical plots were reread using the original three-step method and then reread using a modified Daubenmire cover/frequency method. This allows comparisons between old and new information to help determine ecological condition and trend and establishes a baseline using the more accurate cover/frequency method for gathering future data. We have intermittent data ranging from 1960 to 2014 for these 24 plots. For most of the plots in the Murderers Creek allotment, there is data for at least four years: 1960, 2004, 2010 and 2013. There is less data available for the plots in the Frenchy and Rosebud allotments. A spreadsheet summarizing the data is available in the project record.

According to the data available for these 24 trend monitoring plots, the upland conditions on most sites are either stable or moving toward desired conditions, with the plant community composition remaining stable. The following are exceptions to that generalization:

- Murderers Creek Cluster 7
 - ♦ 2010 - Soil trend was rated as overall static or slightly down, due to prior stream erosion and scouring from flooding, however it was noted that the soil was in stages of recovery. The plant community composition has remained fairly static from 2004 through 2013.

- Murderers Creek Cluster 8
 - ♦ 2010 - Soil trend was slightly down, with signs of horse use throughout the site.
 - ♦ 2013 - While the plant community was still predominantly bluebunch wheatgrass (*Pseudoroegneria spicata*) and Sandberg bluegrass (*Poa secunda*), the invasive North Africa grass (*Ventenata dubia*) was a substantial component (18 percent composition based on foliar cover). This annual, invasive grass was not noted in the data prior to 2013.
- Murderers Creek Cluster 13
 - ♦ 2013 – Bluebunch wheatgrass and Idaho fescue (*Festuca idahoensis*) continue to be the dominant components of the plant community but there was been a substantial increase in the amount of annual grass (23 percent based on foliar cover). The “annual grass” was not identified on the field sheet, but it is likely that it is North Africa grass as noted at Cluster 8.
- Murderers Creek Cluster 14
 - ♦ 2010 – Soil trend rated as downward due to noticeable soil compaction; the plant community remained static from 2004-2013, with large patches of bare soil. Horse use (including stud piles) was noted throughout the site.
- Murderers Creek Cluster 15
 - ♦ 2010 – Soil trend rated as downward due to large areas of bare ground, pedestalling and erosion. The plant community has remained static from 2004-2013 (predominantly rubber rabbitbrush – *Ericameria nauseosa*, and intermediate wheatgrass – *Thinopyrum intermedium*) with large patches of bare soil. Horse use (including stud piles) was noted throughout and near the site.

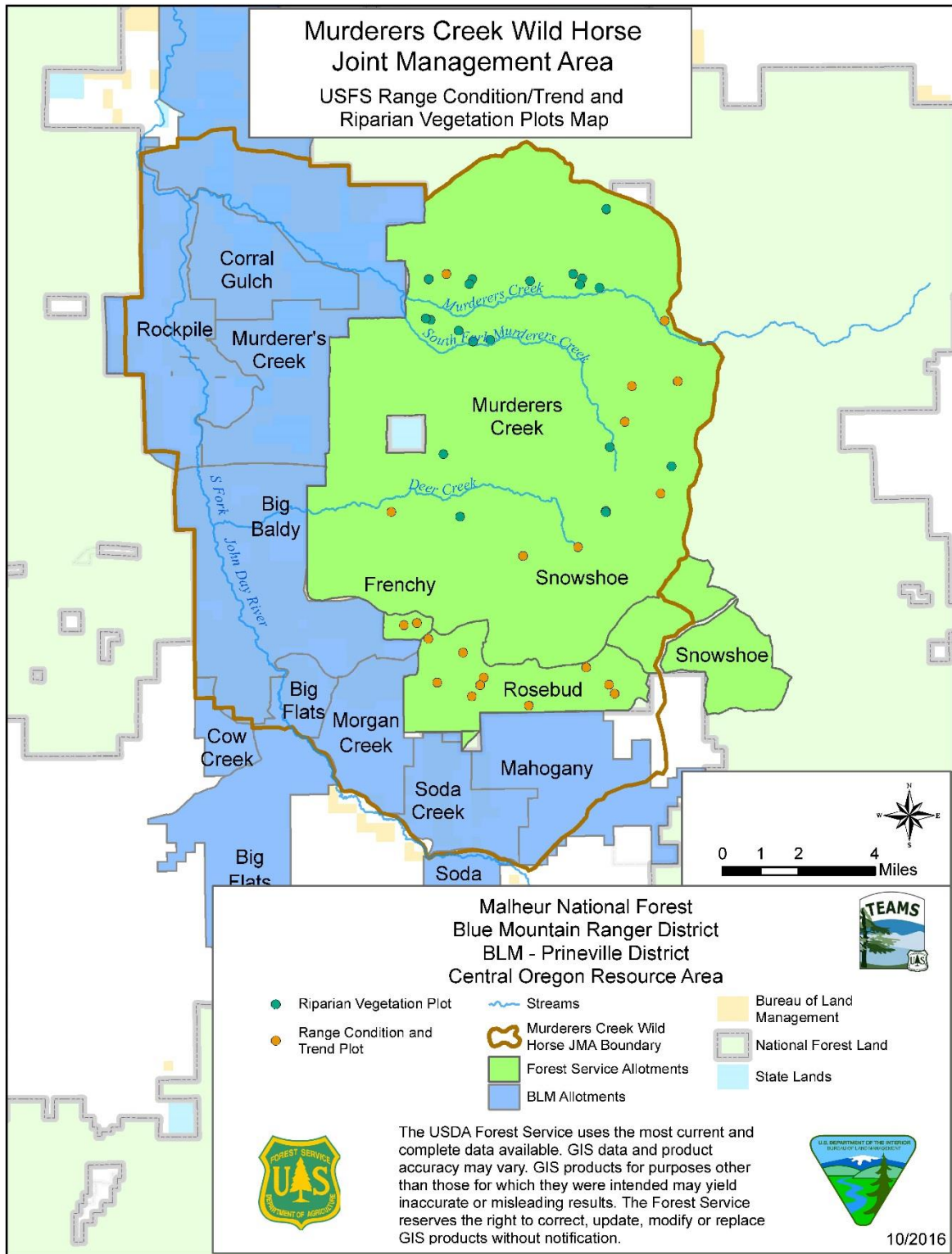


Figure 8 Location of range condition and trend plots and ecological plots, Forest Service allotments

Riparian Ecological Plots

There are 26 ecological sites set up for monitoring the riparian vegetation in the Murderers Creek allotment (also shown in Figure 8). The report documenting the results of the latest monitoring states that while there are areas of concern due to high utilization rates and moderate soil disturbance in the Blue Ridge and Deer Creek pastures, the vegetation in the ecology plots across the allotment has not changed substantially after 20 years. The sites reported as having good conditions in 1989 and 1992 still have good conditions. Other sites continue to be dominated by introduced perennial grasses and are likely in alternate stable states (it is unlikely native grass species will be reestablished) (Mellmann-Brown 2015).

BLM Administered Allotments

Long-term Trend Plots

There are multiple long-term trend plots on the lands managed by the Bureau of Land Management, eight of which were reread in 2014. Intermittent data from 1988 through 2014 were examined as part of this analysis. While it is difficult in some cases to make trend determinations due to the lack of data or inconsistency of data, overall the upland plant communities are relatively stable, with some trending upwards, and an encroachment of woody species on others. Exceptions to this generalization are as follows:

- **Big Baldy TP3** – readings from 2003 and 2014 are very dissimilar. It appears there has been a substantial increase in ponderosa pine (*Pinus ponderosa*) and red fescue (*Festuca rubra*), and a decrease in the amount of Sandberg bluegrass. It is likely the differences in red fescue and Sandberg bluegrass is the result of misidentification; there was no red fescue identified in 2003, the plant community was 30 percent Sandberg bluegrass, yet in 2014 Sandberg bluegrass made up only 2 percent of the plant community and red fescue was 13 percent. The other anomaly for this site is the amount of ponderosa pine. There was no ponderosa pine identified on the site in 2003, and it was 14 percent of the plant community in 2014. This increase is due to a young ponderosa pine tree in the plot indicating an increase in woody vegetation for the site.
- **Soda Creek TPL1** – 2014 data show a substantial decrease in the amount of bluebunch wheatgrass and Idaho fescue and an increase in red fescue and antelope bitterbrush (*Purshia tridentata*). Red fescue was not identified on the site in 2003; the apparent increase could be the result of misidentification.

Indicators of Rangeland Health

While the long-term trend studies discussed above help us to determine where the plant community and soils are in relation to our desired condition, rangeland health assessments attempt to look at how well the ecological processes on a site are functioning (Pellant et al 2005). In 2014, five long-term trend plots were evaluated using the 17 indicators of rangeland health (Pellant et. al. 2005). The locations of these plots is displayed in Figure 9. During these assessments, existing conditions at the site were compared to the reference conditions identified for each particular ecological site. Table 21 is a summary of those assessments. The ratings given for each indicator is an expression of departure from the reference condition.

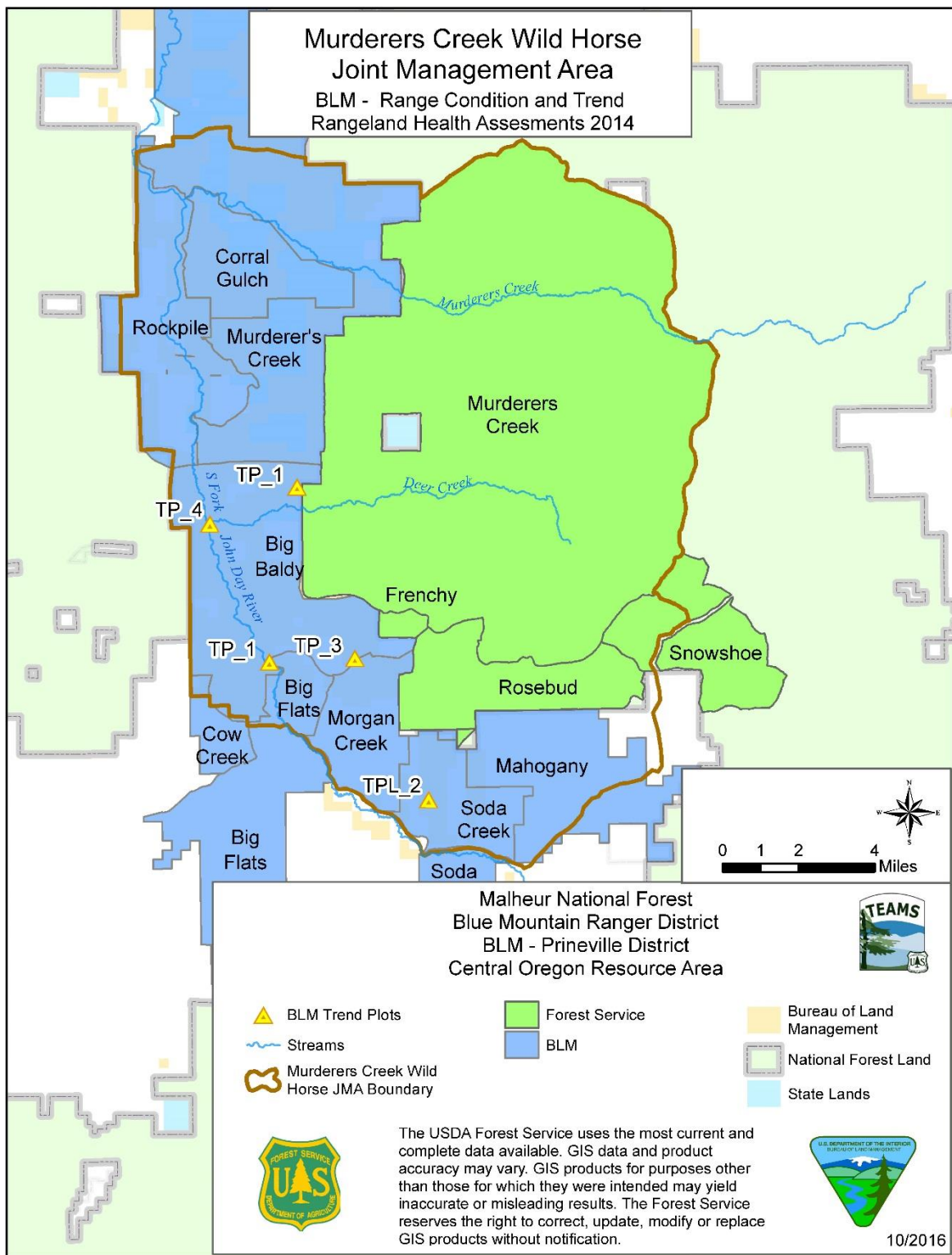


Figure 9 Locations of rangeland health assessments conducted on BLM allotments, 2014

Table 21. Summary of 17 indicators of rangeland health assessments - 2014

Plot	Overall departure from reference ratings		
	Soil/Site Stability	Hydrologic Function	Biotic Integrity
Big Baldy N TP#1	none to slight	none to slight	slight to moderate
Big Baldy N TP#4	none to slight	none to slight	slight to moderate
Big Baldy S TP#3	none to slight	none to slight	slight to moderate
Big Flats Spring TP#1	none to slight	none to slight	moderate
Soda Creek/Poison Creek TPL#2	slight to moderate	none to slight	moderate

The ratings of moderate for biotic integrity in the Big Flats and Soda Creek allotments are due to a shift in the plant community from historical bunchgrasses to annual grasses and trees and an increase in shrubs, respectively. The ratings of none to slight and slight to moderate reflect that overall, the ecological processes are functioning as expected on these sites, although there has been some departure from the reference conditions.

Standards and Guidelines Assessments

The Standards for Rangeland Health and Guidelines for Livestock Grazing Management for Public Lands in Oregon and Washington (Standards and Guidelines) were developed in 1997 (USDI BLM 1997) to meet the requirements and intents of 43 Code of Federal Regulations, Subpart 4180 (Rangeland Health). They were developed to help public land managers meet the objectives of the rangeland health regulations. The fundamentals of rangeland health provide direction in the development and implementation of the standards for rangeland health. The standards are expressions of the physical and biological condition or degree of function necessary to sustain healthy rangeland ecosystems. The five standards are:

- Standard 1 Watershed Function – Uplands
 - ♦ Upland soils exhibit infiltration and permeability rates, moisture storage and stability that are appropriate to soil, climate and landform.
- Standard 2 Watershed Function - Riparian/Wetland Areas
 - ♦ Riparian-wetland areas are in properly functioning physical condition appropriate to soil, climate, and landform.
- Standard 3 Ecological Processes
 - ♦ Healthy, productive, and diverse plant and animal populations and communities appropriate to soil, climate and landform are supported by ecological processes of nutrient cycling, energy flow and the hydrologic cycle.
- Standard 4 Water Quality
 - ♦ Surface water and groundwater quality, influenced by agency actions, complies with State water quality standards.
- Standard 5 Native, Threatened and Endangered, and Locally Important Species
 - ♦ Habitats support healthy, productive, and diverse populations and communities of native plants and animals (including special status species and species of local importance) appropriate to soil, climate, and landform.

The Bureau of Land Management conducts standards and guidelines assessments on grazing allotments to determine if the standards are being met (and if livestock grazing is conforming to the guidelines). If a standard is not being met they determine if there is progress towards the meeting of that standard and if livestock grazing is a contributing (or causal) factor.

Standards and guidelines assessments have been completed on the Soda Creek 4044, Big Baldy 4052, Rockpile 4103, Morgan Creek 4154, and Big Flats 4186 allotments. The following is a short discussion on the findings; the complete assessments are available in the project record.

In 2003, the standards and guidelines assessment on the Soda Creek allotment determined all five standards were not being met, and that livestock were a contributing factor in each case. In 2003, there were moderate to extreme departures from reference for the soil/site stability, hydrological function, and biotic integrity attributes for the 17 indicators of rangeland health. In 2014, those same attributes were evaluated, again using the 17 indicators of rangeland health. They were rated as slight to moderate, none to slight, and moderate departure from reference, respectively, indicating the allotment has made significant progress towards, or is now meeting, the standards due to changes in management.

In 2004, the Big Baldy allotment was meeting all the standards except standard 4 (water quality). It was determined livestock grazing was not contributing to standard 4 not being met, but horses were a contributing factor. On the Rockpile allotment, standards 1, 3, and 5 were met. Standard 2 (riparian/wetland areas) was not, but significant progress was being made. Standard 4 was not being met, but livestock grazing was not found to be a contributing factor. Wild horses were identified as a contributing factor.

The standards and guidelines assessments on the Morgan Creek 4154 and Big Flat 4186 allotments conducted in 2007 found all 5 standards were being met on both allotments.

Level 2 spring surveys

Twenty six springs and their associated wetland/riparian areas were surveyed on BLM lands in 2014 and 2015 (see appendix B – Hydrology Report) using the Groundwater Dependent Ecosystem Survey Level II protocol. Eleven of the springs surveyed were identified as “nonfunctional” due to impacts from horse use, or a combination of horse, livestock and wildlife use, as displayed in table 22

Table 22. Summary of springs that are nonfunctional with impacts from horses (from Appendix B - Hydrology Report)

Spring	Date	Condition – causal factor(s)
Dry Pine Creek	9/25/2014	Nonfunctional - horse
Ellingson Mill Spring 3	9/26/2014	Nonfunctional - horse
Dewey Creek	10/16/2014	Nonfunctional - horse, livestock and elk
Round Creek	10/17/2014	Nonfunctional - horse, livestock and elk
Soda Creek	10/21/2014	Nonfunctional - horse, livestock and elk
Unnamed Spring FSR 820	3/29/2015	Nonfunctional - horse, livestock and elk
Ellingson Mill Spring 4	7/12/2015	Nonfunctional - horse
Site 7	9/17/2015	Nonfunctional - horse
Dry Pine Creek 1	7/10/2015	Nonfunctional - horse
South Tributary Indian Creek	10/19/2014	Nonfunctional - horse, livestock and deer
North Tributary Indian Creek 2	10/14/2014	Nonfunctional - horse, livestock and deer

PacFish/InFish Biological Opinion Monitoring (PIBO)

The goal of the PacFish/InFish biological opinion monitoring program is to monitor stream and riparian habitats within the PIBO study area in order to determine if the PacFish (Pacific Anadromous Fish) and InFish (Inland Fish) aquatic conservation strategies can effectively maintain or restore the structure and function of riparian and aquatic systems.

There have been six reach evaluations (sites evaluated two or more times) within the Forest Service Murderers Creek allotment between 2003 and 20013, while an additional 5 sites were added in 2013, which have been evaluated only once. Within these monitored reaches the data suggests that most stream attributes are improving, while some are remaining relatively static. Overall, most of the habitat conditions showed improvement (a few remained stable) over the time period of the study, meaning that change was trending in the desired direction.

Continuing to meet the allowable use standards, both in the form of move triggers and end of season minimum requirements, should avoid any negative effects to riparian or aquatic habitats that would carry over in any meaningful way to the following grazing season. In the absence of site-specific information to the contrary, it is fair to say that complying with the applicable allowable use standards has a high likelihood of not meaningfully impeding the capacity for the structure and function of riparian and aquatic conditions to achieve recovery.

Proper Functioning Condition

Proper functioning condition is a qualitative method for assessing the condition of riparian wetland areas. The assessment provides a consistent approach for assessing the physical functioning of riparian-wetland areas through consideration of hydrology, vegetation, and soil/landform attributes. The assessment synthesizes information that is foundational to determining the overall health of a riparian-wetland area, and is a prerequisite to achieving desired condition.

Nearly 15 miles of stream reaches on Malheur National Forest-administered lands within the joint management area have been evaluated. In 2004, 39 percent of the stream lengths were considered to be at proper functioning condition while the majority of the reaches were rated as functioning-at-risk but with an upward trend, indicating conditions are moving towards desired condition.

Tier 2 Analysis – Additional Information

Land Use Plan Direction

Forest Service

There are eight Forest Plan-designated management areas within the joint management area: MA 1-General Forest, MA 2-General Rangeland, MA 3B-Anadromous Fishery, MA 4A-Big Game Winter Range, MA 9-Proposed Research Natural Area, MA 10-Semiprimitive Non-motorized Area, MA 13-Old Growth Area, along with the Murderers Creek Wild Horse Territory.

The following standards, goals, and objectives from the Forest Plan relate specifically to wild horse management:

- Forest-wide Standard #83 (Forest Plan pg IV-34) – Conduct livestock management on the Murderers Creek Wild Horse Territory to ensure that resource conditions meet management goals and standards. Resolve conflicts between livestock, big game, and wild horses in accordance with the maintenance of a wild horse herd averaging 100 head.

- Forest-wide Goal #23 (Forest Plan pg IV-2) – Conduct livestock management on the Murderers Creek Wild Horse Territory to ensure maintenance of a wild horse herd averaging 100 head.
- Forest-wide Objective (Forest Plan pg IV-18) – Provide forage to maintain the Murderers Creek wild horse herd at 100 animals and meet big game population objectives agreed upon between the Forest Service, Oregon Department of Fish and Wildlife, and the Oregon Wildlife Commission

These two Forest Plan goals for range also provide direction with respect to range management and other resources (Forest Plan pg IV-2):

- Forest-wide Goal #20 - Provide a sustained production of palatable forage for grazing by livestock and dependent wildlife species.
- Forest-wide Goal #21 - Manage rangelands to meet the needs of other resources and uses at a level which is responsive to site-specific objectives.

Forest-wide standard #87 identifies the forage utilization standards for upland vegetation:

- Forest-wide Standard #87 - Establish annual forage utilization requirements for each grazing allotment as a tool to achieve or maintain the desired condition. Use the forage utilization standards listed in Table IV-2 except (a) in Management Areas 3A, 36, 17, 18, and in specific portions of other management areas; and (b) where site-specific monitoring information has been collected and evaluated which supports a determination that a higher level of utilization will achieve the desired future condition without delaying the rate of improvement. As a minimum, the desired condition must be 'satisfactory.'

TABLE IV-2
Allowable Utilization of Available Forage on Suitable Range
(Percent Allowable Use of Available Forage)^{1/}

Range Resource Management Level	Forest		Grasslands ^{1/}		Shrublands	
	S ^{2/}	U ^{3/}	S	U	S	U
STRATEGY B - Stewardship Management^{4/}	40	0-30	50	0-30	40	0-25
STRATEGY C - Extensive Management^{5/}	45	0-35	55	0-35	50	0-30

^{1/}Utilization based on percent removed by weight for grass, grasslike, and forbs

^{2/}S - Satisfactory condition - See glossary

^{3/}U - Unsatisfactory condition - See glossary

Forest Plan Amendment 29 and PACFISH Amendments

The Forest Plan was amended in 1994 (Amendment 29) in response to the Columbia River Basin Anadromous Fish Habitat Management Policy and Implementation Guide (USDA Forest Service 1991). Under this amendment the Malheur National Forest modified standard 5 of the fish and wildlife resource elements to include specific numerical desired future conditions for Management Area 3A (non-anadromous riparian areas) and Management Area 3B (anadromous riparian areas). The numerical desired future conditions were selected to protect water quality, features of riparian vegetation, and components of fish habitat.

Amendment 29 did not set specific quantifiable standards for wild horse or livestock grazing activities. However, wild horse use of the joint management area can directly affect the attainment of Amendment 29 desired future conditions.

PACFISH applies specifically to the Forest Service lands within the range of anadromy, including all lands within the joint management area. PACFISH amended the Forest Plan. The goals of PACFISH establish an expectation of healthy, functioning watersheds, riparian areas and associated fish habitats. The quantitative riparian management objectives component of PACFISH was developed to measure the progress towards the riparian goals. In general, and to the extent applicable and feasible, the Malheur National Forest manages so as not to prevent or retard attainment of these riparian management objectives unless Forest Plan Amendment 29 is more stringent.

Project- and site-specific PACFISH standards apply to all riparian habitat conservation areas and to projects and activities in areas outside the riparian habitat conservation areas that would degrade them. PACFISH standard GM-4 for grazing management (USDA Forest Service and USDI BLM 1995) is specific to wild horse management:

- Adjust wild horse/burro management to avoid impacts that prevent attainment of RMOs or adversely affect listed anadromous fish.

Bureau of Land Management

The Bureau of Land Management land use designations within the joint management area include Wild and Scenic River; State Scenic Waterway; Aldrich Wilderness Study Area; Big Game Winter Range; Steelhead Critical Habitat; and, Wildland Urban Interface, along with the Murderers Creek wild horse joint management area.

Objective HB1 of the John Day Basin Record of Decision and Resource Management Plan is “Manage the Murderer’s Creek wild horse herd as a self-sustaining population of healthy animals in balance with other uses and the productive capacity of their habitat” (USDI BLM 2015). The following are identified as management actions:

- Continue to manage the Murderer’s Creek wild horse herd jointly with the Malheur National Forest under the guidance of the Murderer’s Creek Wild Horse Territory/Horse Management Area (HMA) Management Plan (October 2007 or current version). Approximately 75 percent of the HMA is National Forest land, and the remaining 25 percent is managed by BLM.
- Continue to manage for a herd size or Appropriate Management Level (AML) of 50-140 horses.

The Resource Management Plan also identifies the following guidelines for the Murderer’s Creek wild horse herd:

1.1 Use the following criteria when considering adjustments in herd size:

- a. Extraordinary circumstances such as wildland fire, extreme drought, disease, or circumstances warranting quarantine may require removal of animals to maintain animal health or an ecological balance with the available habitat.
- a. Excess animals may require removal to comply with court orders.
- b. If wild horses stray outside of their designated boundaries (the herd management area) and the landowner requests their removal, remove them as required by law.

-
- c. When concentrations of horses result in unacceptable impacts on resources, such as riparian areas, remove small groups of horses.
 - d. When population levels surpass the upper end of the AML, schedule gather activities and remove excess horses. The number of horses removed will be those necessary to bring the population down to the lower end of the AML range.
 - e. Fertility control measures, such as the use of the drug porcine zona pellucida or others approved for use, can be used to slow the rate of population increase.
 - f. Gelding or adjusting sex ratios to favor males or other population control measures that reduce population growth rates and extend the gather cycle during gather or herd management area planning for wild horse herds will be considered.

2.1 Gather and remove excess horses as described in the Murderer's Creek Wild Horse Territory/HMA Management Plan (October 2007 or current version) using approved techniques such as helicopter drive trapping, horseback herding to a trap, roping, bait trapping, chemical capture, or net gun capture.

3.1 Determine herd health, habitat condition, and herd size through habitat monitoring and pre- and postgather censuses.

4. 1 Coordinate with local, state, federal, and private organizations to maintain ecological values.

Aquatic Conservation Strategy (ACS)

Aquatic objectives AQ2-AQ12 of the Resource Management Plan constitute the aquatic conservation strategy. The aquatic conservation strategy replaces PACFISH and INFISH on Bureau of Land Management lands in the John Day River Basin. The aquatic conservation strategy includes six key aquatic components: riparian conservation areas, strong hold areas, multi-scale analysis, restoration priorities, management direction, and monitoring.

National Marine Fisheries Service Biological Opinion

In 2013, the National Marine Fisheries Service prepared a biological opinion (NMFS # NRW-2012-716, NMFS 2013) on the effects of implementing the 2007 Murderers Creek Wild Horse Territory/Herd Management Area Management Plan, which included an appropriate management level of 50 to 140 horses. We are including a discussion of the biological opinion here because it contains management constraints that are germane to determining the appropriate management level.

In the final opinion, the National Marine Fisheries Service concluded the proposed action was not likely to jeopardize the continued existence of Middle Columbia River steelhead or result in the destruction or adverse modification of their designated critical habitat. They also provided an incidental take statement with that opinion.

Section 9 of the Endangered Species Act and Federal regulations pursuant to section 4(d) of the Endangered Species Act prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined by the statute as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is defined by regulation to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating,

feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity.

For the consultation, “harass” was interpreted to mean an intentional or negligent action that has the potential to injure an animal or disrupt its normal behaviors to a point where such behaviors are abandoned or significantly altered. Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the Endangered Species Act if that action is performed in compliance with the terms and conditions of the incidental take statement. The incidental take statement includes reasonable and prudent measures the National Marine Fisheries Service considers necessary or appropriate to minimize the impact of incidental take associated with the action. Please note that in this discussion we are not including the reasonable and prudent measures and their associated terms and conditions in their entirety, we are only including those pertinent to this analysis.

The first reasonable and prudent measure is: “Minimize incidental take caused by the proposed action by performing certain horse removal actions when wild horse population estimates exceed AML”. To implement that measure the Malheur National Forest and Prineville District are required to apply the following term and condition:

- If the estimated wild horse population, plus 20 percent annual recruitment, will exceed 140 animals in the fall of calendar year 2013 or any subsequent year, conduct horse removal actions to reduce the total estimated population to 140 animals or fewer by the end of that calendar year.

To implement the second reasonable and prudent measure (which involves monitoring and reporting requirements) the following term and condition is included:

- Conduct a wild horse census survey not less than once per year, calendar year 2015 and thereafter, in any calendar year when the estimated population size is 141 animals or more, and every subsequent year until the estimated population size (inclusive of annual 20 percent recruitment) is 140 animals or fewer.

If there is non-compliance with the terms and conditions identified in the incidental take statement, the protective coverage of section 7(o)(2) will likely lapse (NMFS 2013).

The effects analysis section of the biological opinion concludes that incidental take is reasonably certain to occur when juveniles are displaced from preferred locations and as a result of increased fine sediment inputs to the streambeds. The number of individual Middle Columbia River steelhead harmed or harassed by these two pathways, displacement and sedimentation, cannot practically be counted. The individual juvenile steelhead and eggs that will be taken by reduced condition from reduced forage, and suffocated from reduced intergravel dissolved oxygen, are scattered across remote and rugged stream reaches that are practically inaccessible, especially in winter, for observation and collection of small, numerous, and sometimes buried, individual specimens. Any attempt to collect and study juveniles and eggs, to a statistically useful extent, would disturb and injure far more individuals than the wild horses do. So, the National Marine Fisheries Service provides a quantified and measurable extent of take to serve as a surrogate indicator for the amount of take (NMFS 2013).

The National Marine Fisheries Service concluded implementing the wild horse management plan will cause incidental take of Middle Columbia River steelhead. They also concluded the wild horse population size is the best available extent of take indicator that is proportional to that amount of take. They acknowledge that the Forest Service and Bureau of Land Management identified situations that may limit their effectiveness at reducing herd size and maintaining the appropriate management level at 140 horses,

and that some modest and temporary exceedances of the appropriate management level as reasonably likely. The National Marine Fisheries Service anticipated some exceedances in their analysis of effects but stated that long-lasting exceedance will indicate incidental take in excess of what was contemplated in the National Marine Fisheries Service opinion (NMFS 2013).

Appendix B: Hydrology Report – BLM lands

This report provides an inventory of water sources within the Murderer’s Creek Territory. This is not a comprehensive list of all water sources, but rather a reference list of what were known to be the major water sources within the Territory based on available maps and previous surveying. The objectives of this surveying exercise were to describe the major physical and biological characteristics of these water sources and determine the sites’ general condition. The Groundwater Dependent Ecosystems (GDE): Level II Inventory Guide (USFS, 2012) provides a framework to comprehensively characterize the vegetation, hydrology, geology and soils of GDEs and therefore was selected for this exercise.

Each site’s general condition, either functional or non-functional, was established based on observations of natural and anthropogenic disturbances that were detrimentally affecting the structure and integrity of the site. The GDE Guide includes two components to help assess functionality: the Disturbance section and the Management Indicator Tool. The Disturbance section documents existing hydrologic and soil alteration, human structures and recreational effects, animal effects and/or others such as fire or timber harvest. The second component to help assess functionality, the Management Indicator Tool, includes 25 management indicator statements to be answered as “true” or “false” in the field using a field crew consensus approach and later validated based on a review of all data collected (USFS, 2012).

For the Murderer’s Creek area, a functional GDE is generally one that maintains aquifer functionality, soil integrity and vegetation composition. A functional site usually had evidence of soil saturation or standing water sufficient to maintain hydric soils with no excessive erosion or compaction, and expected vegetation exhibited seasonally appropriate health and vigor. A nonfunctional site in the Murderer’s Creek area was generally depleted of aquifer recharge as indicated by upland plant species encroachment, or affected by groundwater extraction as indicated by changes in soil saturation or spring flow. The majority of nonfunctional sites have been heavily grazed by horses, livestock and/or wildlife, resulting in alteration of the soil structure from pedestals created by hoof shear and hoof compaction. Vegetation condition was also adversely affected by severe grazing and browsing, and may have decreased in diversity. The table below summarizes GDE functionality and dependability as a water source. Out of 32 sites surveyed, 7 were found to be functional and 13 nonfunctional, dependable water sources. All nonfunctional sites had a combination of effects, but 8 out of the 13 nonfunctional sites had mostly heavy horse use causing detrimental conditions. The other 5 nonfunctioning sites had also a combination of sources but mostly ungulates and livestock use causing detrimental conditions. Three seasonal sources were identified, and all found to be nonfunctional. Two of the seasonal sites were mostly affected by horses, and one site mostly affected by ungulates and livestock use. Lastly, nine previously mapped water sources do not have wetland characteristics and are not considered GDEs. A summary of each site is provided below. Full details of the inventory and survey forms are located in the project record.

Table 23. Summary of Water Sources Condition

Water Source	GDE Functional	GDE Non-Functional	
		Major effects (horses)	Major effects (others such as livestock and wildlife)
Dependable	7	8	5
Seasonal	0	2	1
No GDE anymore		9	

Dug out Creek Spring: This undeveloped meadow area runs approximately 20 feet east of the perennial Dug out Creek, and 245 feet east of a spur road of the 270 Road. The meadow includes an area of approximately 4165 ft². A site visit on July 2015, documented the meadow had no surface flow and mostly pockets of standing water in between hummocks and a larger 42 ft² ponded area. The majority of the documented hoof action was from horses. Minimal grazing was noted primarily along a trail running by the eastern edge of the meadow. Impacts were low enough that the meadow appeared to be in a functional condition and a dependable water source for the Territory along with the adjacent perennial stream






Dry Pine Creek Spring: This meadow area runs along an intermittent stream flowing into the Dry Pine Creek. A rusted out spring box provides evidence of previous development. The meadow includes an area of approximately 8073 ft². A site visit on September 2014, documented the meadow had no surface flow and mostly pockets of standing water in between hummocks. Heavy ungulate use has resulted in significant ground disturbance, soil displacement, and mixing. Most of the documented hoof action was from horses. Heavy grazing along with several horse stud piles was noted in the vicinity. Due to the level of impact, the meadow appeared to be nonfunctional but a dependable water source for the Territory.



Ellingson Mill Spring #4: This hillslope seep includes an area of approximately 2400 ft². The site appeared to be an old stock pond, mostly covered by thick brush now. A site visit on July 2015, documented the seep had minimal surface flow that quickly dissipates. The exposed outflow has been heavily trampled and is part of a horse trail. All the documented hoof action was from horses. Due to the level of impact, the seep appeared to be nonfunctional but a dependable water source for the Territory.



<p>Ellingson Mill Spring #3: This hillslope seep includes an area of approximately 883 ft². The site appeared to be an old historical site used to divert water. A site visit on September 2014, documented the seep had minimal surface flow that quickly dissipates. The exposed outflow has been heavily trampled resulting in mostly pockets of standing water in between hummocks. Heavy ungulate use has resulted in significant ground disturbance, soil displacement, and mixing. Vegetation has been heavily grazed. Horse presence was evident. Due to the level of impact the seep appeared to be nonfunctional but a dependable water source for the Territory.</p>	
<p>Dry Pine Creek Spring # 1: a site visit on July 2015, documented the area forms as a result of a road closure, which berm currently accumulates surface flow. No spring features were observed but mostly wet trampled soils. Heavy grazing along with several horse stud piles was noted in the vicinity. The site is non-functional due to the high level of disturbance, but can be developed as a seasonal water source for the Territory.</p>	
<p>No Name Spring Indian Creek: This undeveloped wetland area runs approximately 120 feet south of the perennial Indian Creek on an unnamed southern tributary to Indian Creek. The entire site is approximately 39,665 ft² with a sampled area of about 8,175ft². A site visit in March 2015 documented the wetland had diffused surface flow and standing water in pools and in pockets in-between hummocks. The majority of the documented hoof action was from livestock resulting in ground disturbance, soil displacement, mixing and churning and compaction. The wetland appeared to be nonfunctional, due to the high level of disturbance, but a dependable water source for the Territory along with its adjacent perennial stream.</p>	

St Clair Spring #2: This undeveloped meadow includes an area of approximately 904 ft². A site visit on October 2014, documented the meadow had fen characteristics with deep organics and spongy upper soils. The diffused surface flow and pockets of standing water in between hummocks showed the heavy hoof action from livestock and elk heavy grazing. A stock tank was documented uphill from the spring. The wetland appeared to be nonfunctional due to the high level of impacts but a dependable water source for the Territory.



Dewey Creek Spring: This undeveloped hillslope spring arises within the headwaters of Dewey Creek. A site visit in October 2014 indicated a steep, long and narrow site with diffused flow within an actively eroding depositional runout. The site was mostly bare, saturated, un-cohesive soil except along the edges. The site shows a lot of ground disturbance, soil displacement and mixing related to the headward erosion of headcuts on a very steep slope (60%). There is evidence of browsing, hoof action and manure from horses, cattle and elk with many trails crisscrossing the area including one crossing the site itself. The spring appeared to be nonfunctional, due to active erosion and animal impacts at the site, but a dependable water source for the Territory



Frazier Creek Spring: This undeveloped hillslope seep includes an area of approximately 1,290 ft². It is located about 100ft uphill from a spur road that runs along Frazier Creek. A site visit in October 2014 showed the site had no standing water or flow. Hydric soil formation was minimal with very little to no saturated soils under redox conditions. There was some water in the outflow channel, but this dissipated underground again, and then re-emerged in the road at the base of the slope, where there was standing water. Some grazing, trampling and trails by ungulates was noted, primarily cattle and elk. The seep itself appeared to be nonfunctional due to the dryness of the site and lack of hydric vegetation. The presence of water downslope from the site indicates that it is a seasonal water source for the Territory.



Martin Creek Spring: This hillslope wetland is located in-between a spur road that runs along Martin creek and the creek itself and empties into Martin Creek. It includes an area of 1,300 ft² and appears to be an old historical site used to create ponding as evidenced by the remnants of a berm at the end of the outflow just before it enters Martin Creek. A site visit in October 2014 showed diffused surface flow and small patches of standing water in hoof prints. There is evidence of browsing and hoof action from cattle and elk producing hummock formation as well as moderate ground disturbance, soil displacement, trampling and soil mixing and churning. The site appears to be nonfunctional due to the level of impact, but is a dependable water source for the Territory



Peewee Headwaters Spring2: This site is a phreatic, shallow groundwater dependent spring located in the headwaters of Peewee Creek. The valley bottom is currently overstocked with trees which evapotranspire significant amounts of water. This along with head cuts, which are currently eroding upstream through the spring site area, is decreasing the amount of water available for wetland vegetation and wildlife. Downstream from this site is a stock pond created by an earthen dam in the stream channel. Two site visits were made in August and October of 2014. At the first visit (see September photo) there was a moderate amount of disturbance related primarily to native ungulate use (elk). On the visit in October (see October photo) there was evidence of greater amounts of grazing and hoof action producing ground disturbance, soil trampling, mixing and churning. Most of the documented hoof action on the second visit was from horses. This site appears to be non-functional due to the large amount of disturbance, but is a dependable water source for the Territory.



September visit 2014.

October visit 2014.

Round Creek Spring: This undeveloped hillslope wetland has an area of about 4,850ft². It is located 50 feet NW from a spur road that runs along Round Creek and its downslope edge abuts the creek into which it drains. A site visit in October 2014 showed the site had surface water in small pockets formed by hoof prints, with mostly dispersed flow. Hummock formation, trampling, soil mixing and churning were observed as well as heavy grazing in and around the site. Horses were observed in the area, but the hoof traffic appeared to be from horses, cattle and native ungulates with a major trail running along the east side of the spring. There is some head cutting at the spring source which is related to animal use, but also may be due to recent fire which has removed the majority of the canopy in the area. This may affect ground water flow which could be causing increased erosion at the site. The site is nonfunctional due to the amount of disturbance but provides a dependable source of water for the Territory.



Rail Ridge Spring: This site is located just west of a spur road located on Rail Ridge. This 2,190 ft² site is a hillslope spring that has been developed with pipes from underground diverting about 80% of the spring flow into a stock tank, which returns about 90% of the diverted flow back into a down slope wetland. A site visit in October 2014 found the stock tank filled to its estimated 680 gallon capacity with water flowing out through an outlet on the down slope end of the tank at about 0.2 gallons/minute. Heavy ungulate use has resulted in significant ground disturbance, soil displacement, and mixing. Most of the documented hoof action was from cattle. Heavy grazing and numerous trails were noted in the vicinity. The stock tank appeared to be in satisfactory condition and a dependable water source for the Territory.



Soda Creek Spring: This undeveloped site is mostly wet meadow and is about 60,925 ft². This large area has multiple spring sources along the northeast edge of the site which forms the headwaters for the drainage area. The sample site was approximately 3,520ft². A site visit on October 2014, documented the meadow had fen characteristics with deep organics and spongy upper soils. The diffused surface flow and pockets of standing water in between hummocks showed the heavy hoof action from livestock, horses and elk. The area was heavily grazed and showed trampling along with soil displacement related to hoof shear. The wetland appeared to be nonfunctional due to the high level of impacts but a dependable water source for the Territory.

This site was revisited in October 2015 after cattle had been removed and a horse gather had been conducted. There were still slight signs of grazing by native ungulates and, although hummocks remained, there was significantly less evidence of trampling and soil disturbance.



October 2014 visit.



October 2015 visit

South Tributary Indian Creek: This site consists of two stock ponds located in the channel of an unnamed southern tributary of Indian Creek. They were created by an earthen dam downstream from both, with a berm dividing the two. The upstream pond is about 1,400 ft² while the lower pond is about 1,200 ft². A site visit in October 2014 showed neither had water at the time, but showed higher moisture levels with greener vegetation than surrounding areas. The site is heavily grazed and trampled with hummock formation, ground disturbance, and soil mixing and churning. Horse, cattle and deer scat were present. There are also trails completely circling the ponds and leading into them with erosion due to hoof shear on the edges of both. The site is nonfunctional due to the level of disturbance and a seasonal source of water for the Territory.



Ellingson Mill Spring 1: This hillslope spring is undeveloped and has a small (200-300 ft²) associated wetland which has 98% shrub/tree cover with few forbs underneath. A site visit in September of 2014 showed diffuse flow with small pockets of water in hoof prints. There was evidence of grazing and browsing by ungulates, mostly horse and elk. There was some hummock formation around a trail that crosses the spring, but the site was mostly protected by the dense tree and shrub cover. This site is functional and a dependable source of water for the Territory.





North Tributary Indian Creek: This site is located at the headwaters of an unnamed northern tributary to Indian creek. A site visit September 2014 showed the site was completely dry with no sign of a wetland or any wetland plants in the area, but it did have signs of seasonal flow, with some mossy areas. No animal disturbance was noted at the site, but it appears to be nonfunctional and an undependable water source for the Territory possibly because of the current 2 year drought in the area. It could possibly be developed as a seasonal water source.



North Tributary Indian Creek 2: This is a small site (about 100 ft²) located on an unnamed northern tributary of Indian Creek, about 0.1 mile downstream from the other site on the tributary. This is a phreatic, seasonal wetland with a very shallow subsurface water source. A site visit in September 2014 indicated only moist soils, with no surface water, but there were a few wetland plant species. It may be dry, in part, due to drought conditions of two years standing. Ungulate scat and hoof prints were present including horse, cattle, elk and deer. Numerous trails were around the site as well as in the site itself with soil disturbance and trampling. This site appears to be nonfunctional due to disturbance and drought, but is a seasonal water source for the Territory.



<p>Ellingson Mill Spring 2: This site is dry, possibly due to drought conditions. The only remaining signs that water has been present are a small dry channel and willows. It is possible that it could be developed in future to provide a water source, but at this time it is not functioning properly due the drought and should not be considered a dependable source of water for the Territory.</p>	
<p>Wildcat Gulch Spring: This site is located 0.25 miles east of the Dry Soda Creek Road, 2 miles in from highway 68. This spring no longer exists. It has been dewatered by deep head cutting in Wildcat Gulch. There are wet soils in this drainage near Dry Soda Creek Road, almost a quarter mile from the site. This site is not functioning due to dewatering and cannot be considered a reliable water source for the territory.</p>	

Unnamed Spring Forest Service Road 820: This undeveloped wetland area is approximately 0.3 miles east of Wildcat Creek off FS road 820, and has an area of approximately 1,350 ft². A site visit in March 2015 documented the wetland had diffused surface flow and standing water in pools and in pockets in-between hummocks. The documented hoof action was from ungulates including horses, cattle, elk and deer. There was heavy trampling to the area resulting in ground disturbance, soil displacement, mixing and churning and compaction. In some places it had been trampled to bare soil and water. The wetland appeared to be nonfunctional, due to the high level of disturbance, but a dependable water source for the Territory.



Site 7: This area is large, 11,650 ft², with a dense, 98% cover, of riparian shrubs and trees along the edge and downslope from a seasonal drainage. It is located 230 feet N of Dry Pine Creek road, 0.5 miles from the South Fork of the John Day River road. The only wet soils were in a small seep in the stream channel. A site visit in October 2015 showed a small pool of standing water with a very small outlet channel which had a trickle of flowing water which dissipated into the soil downslope, forming a very small wetland about 200 ft². There were small pockets of water in hoof prints in this area. The majority of the hoof traffic was from horses, with trails on both the east and west side of the site and hoof shear on the edge of the small pool. There was also sign of deer and old cow manure, Due to the level of disturbance this site is nonfunctional, but a dependable source of water for the Territory.



Site 9: This undeveloped wetland is located 0.2 miles N of Deer Creek Rd 1.7 miles from the South Fork of the John Day River. It has an area of approximately 3,050 ft² with drainage channels on both the WSW and ENE ends of the wetland. A site visit in October 2015 found standing water in pools with a diffuse flow. The water dissipates before entering either of the outflow channels. There was little sign of grazing, although some old cow and horse manure were present. Most of the hoof traffic appeared to be from native ungulate traffic (deer and elk) with little ground disturbance. With the small amount of disturbance, the site is functional and a dependable water source for the Territory.



Site10: This wetland is about 3,300 ft², and is undeveloped although there is a stock pond about 460 feet downstream from the site. A site visit in October 2015 found diffuse flow, with small pools of standing water. There was a small amount of standing water and moist soils in the outflow channel for about 60 feet where the water then dissipated into the soil. The site showed mostly native ungulate use (deer and elk), but there were some old horse and cattle sign as well. There was little sign of grazing the first day we visited, but when we returned the next day, there were fresh elk tracks and grazing on the W end of the site. There was little sign of trampling or soil disturbance except around two small pools on the W end. Due to the low level of disturbance, this site is functional and a dependable source of water for the Territory.



Site10P: This site is documented in the paperwork for Site 10. It is a stock pond created by an earthen berm located about 460 feet downstream from where the outflow from Site 10 joins another unnamed creek, with both creeks contributing water to the site. A site visit in October 2015 found both streams dry where they enter the pond, but there is water upstream where the outflow channel from site 10 still holds a little water for about 60 feet past the wetland, indicating the pond may still be receiving subsurface flow. Horse, cattle, elk and deer scat and hoof prints are all around the area along with well-developed trails. The stock pond is not a spring or wetland ecosystem, but it is a dependable water source for the Territory.



Site 12: This site is located on Cougar Gulch near the west end of road 269. It is a stock pond created by an earthen dam in Cougar Gulch just downstream from the convergence of Cougar Gulch and an unnamed tributary with both contributing water to the site. What appears to be an old spring box is located just upstream from the pond in the unnamed creek as is another pond, also formed by an earthen dam. A site visit in October 2015 found both streams as well as the upper pond dry. Water in the downstream pond had a surface area at this time of 1916 ft². Old horse scat as well as native ungulate hoof prints (deer and elk) are all around the area. The stock pond is not a spring or wetland ecosystem, but it is a dependable water source for the Territory.



Site 14: This site is located near the head waters of Water Gulch off of road 340. It is a stock pond developed by the BLM in 1973 with an earthen dam located downstream from the convergence of Water Gulch with an unnamed tributary with both contributing water to the site. A site visit in October 2015 found water in the pond with a surface area at this time of about 11,000 ft². Old horse scat as well as native ungulate hoof prints (deer and elk) are all around the site and elk could be heard bugling in the distance. There are many trails crisscrossing the area around the pond. The stock pond appeared to be in satisfactory condition and a dependable water source for the Territory.



Site 15: This undeveloped area does not have wetland characteristics. It is located about 0.4 miles east of the South John Day River road 1.5 miles north of Lantern Creek. A site visit in October 2015 showed no standing water, saturated soils or wetland vegetation. This site did have greener vegetation and a different plant community than the surrounding area indicating there may be more surface moisture in this area. This is not a functional wetland and is not a source of water for the Territory. Site 17 is located in the same area and does have available water.



Site 16: This site is located about 0.4 miles east of the John Day River Road, about 0.4 miles north of where Lantern Creek converges with the South Fork of the John Day river. This site is small (about 850 ft²) and is one of several small seeps located in the stream bed of a seasonal stream. On a site visit in October 2015, there was a small amount of open water available, mostly in hoof prints. Hoof traffic was mostly from native ungulates. There was a scant amount of old cow manure in the area as well, but no sign of horses. The site appears to be functional due to the lack of disturbance and a dependable source of water for the Territory.



Site 17: This is a small (800 ft²) seep in a seasonal drainage channel on a 75% slope. It is located about 0.4 miles east of the South John Day River road 1.5 miles north of Lantern Creek. A site visit in October 2015 showed wetland forbs with small pockets of open water, mainly in hoof prints. Although there was some old cow manure in the area, the main hoof traffic was from native ungulates (deer and elk) with no sign of horse presence. There was little soil disturbance making this seep functional and a dependable water source for the Territory.



Upper Spring West Tributary Poison Creek: This site has a developed well and a solar powered pump which provides water to recently installed structures including a “tuff shed” and outhouse. The overflow is piped through two watering troughs, with the lower trough draining overflow into an excavated stock pond. A site visit in July 2015 showed no indicators of organic soils or natural surface/ground water interactions. Wetland vegetation was limited to a few *Juncus* species. The stock pond, prior to the new overflow, had been dry for a long time. The watering troughs are in good condition and are a dependable source of water for the Territory.



Appendix C: Analysis Process

The appropriate management level determination process described here is from the Bureau of Land Management Wild Horses and Burros Management Handbook H-4700-1, Appendix 3 (USDI BLM 2010). Forest Service Manual 2260 directs us to establish population levels by considering (a) number of animals, (b) suitability of range, (c) range condition and trend, and (d) other associated resources and resource use activities (USDA Forest Service 2003). The process detailed in the Bureau of Land Management Wild Horses and Burros Management Handbook H-4700-1, appendix 3 (USDI BLM 2010) meets the direction outlined in the Forest Service manual.

We are using the Bureau of Land Management handbook for this analysis despite limitations identified by the National Academy of Sciences National Research Council. To the degree feasible, we incorporated information from the National Academy of Sciences committee report.

The National Academy of Sciences National Research Council committee evaluated how we could use the best science available to improve management of horses and burros on the range (Committee to Review the Bureau of Land Management Wild Horse and Burro Management Program 2013). They determined the following:

- The BLM Wild Horses and Burros Management Handbook H-4700-1 (USDI BLM 2010) provides some degree of consistency in goals, allocation of forage, and general habitat considerations, but it lacks the specificity needed to adequately establish and adjust appropriate management levels.
- The process for establishing, monitoring, and adjusting appropriate management levels is not (1) transparent to stakeholders, (2) supported by scientific information, and (3) amenable to adaptation with new information and environmental and social change.

The following is directly from the Bureau of Land Management Wild Horses and Burros Management Handbook H-4700-1, Appendix 3 (USDI BLM 2010), except where edited to make it applicable to the Forest Service also:

Appropriate management level decisions determine the number of wild horses to be managed within an established territory. The appropriate management level is expressed as a population range with an upper and lower limit. The upper limit is the number of wild horses which results in a thriving natural ecological balance and avoids a deterioration of the range. The lower limit is normally set at a number that allows the population to grow to the upper limit over a 4- to 5-year period, without interim gathers to remove excess wild horses.

A multi-tiered analysis process is used to establish and adjust the appropriate management level of wild horses:

- **Tier 1:** Determine whether the four essential habitat components (water, forage, cover, and space) are present in sufficient amounts to sustain healthy wild horse populations and healthy rangelands over the long term.
- **Tier 2:** Determine the amount of sustainable forage available for wild horse use.
- **Tier 3:** Determine whether or not the projected wild horse herd size is sufficient to maintain genetically diverse wild horse populations (i.e., avoid inbreeding depression).

If the tier 1 analysis determines one or more of the essential habitat components is insufficient to maintain a healthy wild horse population and healthy rangelands, the authorized officer should consider amending or revising the Forest Plan to remove the area's designation as a wild horse territory.

Tier 1

In tier 1, we determine if the four essential habitat components (forage, water, cover, and space) are present in sufficient amounts to sustain healthy wild horse populations and healthy rangelands over the long term. In making this determination, the most limiting factor(s) within the Territory should be considered. In some territories, the most limiting factor may be:

- ♦ *The water available for wild horse use.*
- ♦ *Low annual rainfall or extended periods of drought.*
- ♦ *The naturally occurring, low productive capability of the dominant ecological sites.*
- ♦ *The limited habitat available for wild horse use on either the summer or winter range.*
- ♦ *The low ecological status of key wild horse use areas.*

The essential habitat components must be located on public lands within the Territory boundary. If forage or water located on private lands within the Territory is needed to maintain healthy wild horse populations, a written agreement with the private landowner allowing use by wild horses is required. In the absence of private landowner agreement, the forage and water on private lands is not available for use by wild horses and may not be included when establishing or adjusting appropriate management level.

Water

The amount of water available for wild horse use is generally based on public, natural waters (i.e., water occurring on private lands is not considered unless a written agreement with the private landowner is obtained). Water availability during drought conditions is also considered. Sufficient water for wild horses must be available during drought to achieve and maintain a thriving natural ecological balance and multiple use relationship on the public lands.

In determining the amount of water available for wild horse use, a thorough inventory of the available public, natural water resources is needed. Developed and man-made waters should also be inventoried if they are available for wild horse use (i.e., the Forest Service holds the necessary water rights and wild horse access to the water can be depended on over the long term). The water resources inventory should include the name, location, and flow (in gallons per minute or cubic feet per second). Wild horses require a minimum of 10 gallons of available water per animal per day (15 gallons per day is not unusual during the hot, dry summer months). The analysis of available water should also be based on the most limiting season of the year (i.e., generally summer when flows are reduced).

Forage

In this document, we deviated slightly from the Bureau of Land Management handbook when determining the amount of forage available for wild horse use. We expressed the amount available as pounds of forage instead of expressing it in animal unit months.

The Bureau of Land Management handbook describes using utilization monitoring and use pattern mapping for determining forage availability. For this joint management area, we attempted to use the weighted-average use as described in the handbook, but found the lack of data across the joint

management area to be too limiting. Instead we used a method based on plant community types using GIS data and other references (including ecological site descriptions). This helped us determine an approximate average for the forage produced based on the plant community present. This forage production data was then used in a model that considers topographical slope and distance to water to calculate the actual forage available.

The flexibility to remove wild horses in below-average forage years or to move the animals to another area can be constrained by funding, contractor capability, facility space, or animal behavior. To prevent range damage or adverse impacts to animal health, the upper limit of appropriate management level for wild horses should consider the most limiting forage or water production years.

Other Considerations

1. Situations in which the Land Health Standards are achieved but population inventory indicates more wild horses are present than expected. *These situations may indicate additional forage is present to support use by higher numbers of wild horses, wildlife, or livestock, consistent with Forest Plan/Resource Management Plan guidance.*

2. Situations in which deteriorated land health conditions exist but population inventory indicates the number of wild horses is the same or lower than expected. *These situations may indicate there is less forage available to support the existing use by wild horses, wildlife, or livestock, and a reduction in the allowable use may be needed, consistent with Forest Plan/Land Resource Management Plan guidance.*

The number of wild horse and burros which can be sustained based on the available forage is determined in Tier Two. To determine if there is sufficient forage to sustain long-term wild horse and burros:

- ♦ *Analyze utilization data, use pattern mapping, and/or production, ecological site condition, trend, frequency, precipitation (weather), and indicators of land health.*
- ♦ *Determine the actual use by wild horses for each of the evaluation years. Calculate the actual wild horse and burro use based on population estimates derived from aerial surveys. You can also project actual use by wild horses using previous population estimates together with herd's average annual population growth rate.*
- ♦ *Identify key wild horse use areas (distribution). Calculate carrying capacity on the basis of the key use areas (primary range).*

Cover and Space

A recurring pattern of wild horse movement out of the territory to access forage, water, or thermal or hiding cover is an indication the territory cannot sustain year-long wild horse use. If one or more of the key habitat components is missing, the territory should be considered as unsuitable for year-long use by wild horses. In these situations, the authorized officer should consider amending or revising the Forest Plan to remove the area's designation as a wild horse territory.

Tier 1 Summary

The results of the tier 1 analysis will be summarized in a table. The table will be followed by a detailed description of the analysis and the rationale used in making the determination that a key habitat component either is (or is not) sufficient to support healthy wild horse populations and healthy rangelands over the long-term.

Tier 2

Determine the amount of sustainable forage available for wild horse use. Based on the desired level of forage utilization, propose an appropriate management level for wild horses, expressed as a range with an upper and lower limit.

Forage availability should be determined based on in-depth analysis of rangeland monitoring data. As a first step, monitoring data should be reviewed to determine if Forest Plan standards or other site-specific vegetation management objectives are being met. If standards and objectives are being met, wild horse population estimates are then examined to determine the range in number of wild horses using the territory during the evaluation years. The upper values are used to establish AML when no land health issues occur.

In territories where Forest Plan standards or other objectives are not being achieved, wild horse use should be examined to determine if this level of use has contributed to or is the causal factor for the standards or objectives not being met (or only partly met). When standards or objectives are not being met and wild horse use is a contributing (or causal) factor, the AML is proposed based on the estimated number of wild horses present relative to the level of forage utilization that is occurring (i.e., AML would be established at a number below that which has contributed to the standards or objectives not being met). The need for frequent emergency removals of wild horses due to lack of forage and/or water or the emigration of wild horses out of the territory due to population size or concentration levels may also be a consideration in proposing AMLs for wild horses.

The sustainable forage (carrying capacity) available for wild horses use within a territory is determined pending detailed analysis of utilization data and use pattern mapping for all users. For each evaluation year determine the following: (1) weighted average utilization, (2) potential carrying capacity, and (3) the proposed carrying capacity.

Tier 3

Determine whether or not the wild horse herd size proposed in tier 2 is sufficient to maintain genetically diverse wild horse populations (i.e., avoid inbreeding depression). To avoid inbreeding depression in wild horse populations, a minimum herd size of 50 effective breeding animals (a total population size of about 150 to 200 animals) is recommended.

If the herd size proposed in tier 2 is not sufficient to maintain genetically diverse wild horse populations, determine if there is wild horse interchange between the territory and other adjacent territories and whether this interchange would be sufficient to maintain genetic diversity (avoid inbreeding depression). Genetic diversity baseline or monitoring information can be used to evaluate whether wild horse interchange between territories is occurring.

If the proposed herd size is less than 150 animals and the territory is isolated with limited potential for wild horse egress/ingress, possible management actions which could be considered include:

- a. Removing the area's designation as a territory through amending the Forest Plan.*
- b. Maximizing the number of breeding age wild horses in the herd (animals age 6 to 10 years).*
- c. Adjusting the sex ratio to favor males to encourage formation of additional breeding harems.*

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- d. *Introducing 1 to 2 young mares from outside the territory every generation (about every 10 years). Introduced animals should come from herds living in similar environmental conditions.*